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DESCRIPTION
OF
FARNAM'S
PATENT HYDRAULIC APPARATUS,
FOR
RAISING WATER;
INCLUDING
RULES, TABLES, PRICE LISTS, AND OTHER PRACTICAL INFORMATION
ON THE SUBJECT OF
SUPPLYING FAMILIES, FACTORIES, TOWNS, CITIES, &c. WITH WATER.
ALSO, DESCRIPTIONS OF
FIRE ENGINES, FOUNTAINS, &c.

ILLUSTRATED WITH ENGRAVINGS.

---

eorge
BY G. B. FARNAM,
MANUFACTURER OF METALLIC PUMPS, FIRE ENGINES, HOSE, FOUNTAINS, ETC.,
34 CLIFF-STREET, NEW-YORK.

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INTRODUCTORY REMARKS.

THE subject of this work is interesting, *directly* or *indirectly*, to every person. A supply of pure water is not only necessary to life, but a luxury conducive to health and happiness. The demands for apparatus for protecting buildings against fire, &c., has induced me to put together such remarks as may be useful, and not readily found in books. My object in the present publication is to explain the operation of pumps in different situations, and the plans of working them; the description of pumps best adapted for various situations requiring them; together with remarks respecting pumps for ships and steamboats, and for securing other buildings against fire, &c.

It may be proper here to state, that this work is not intended to enter largely into the subject introduced, but merely to give, in as condensed a form as possible, such practical information as may be useful both to the person wishing hydraulic apparatus, and those putting them into operation.

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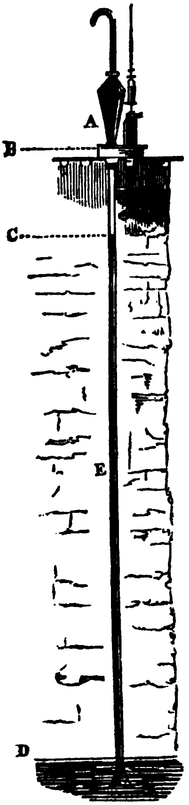
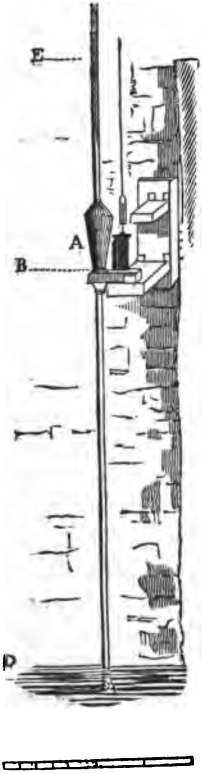
ATMOSPHERIC PUMPS.

In the use of pumps placed above the fountain, and connecting with it by pipes leading either horizontally or perpendicularly, or both united, (the water to be raised by the pressure of the atmosphere,) it may be necessary to explain the reason why water cannot be raised by a pump, the buckets or piston of which are placed more than 33 feet, or thereabouts, in a perpendicular line above the surface of the water. Although the fact may be known to most people, yet many do not know the reason why it cannot be done; and I have had applications for pumps to be placed sixty feet above the water, the applicants thinking that extra valves, placed a short distance apart, would enable them to raise water to that height.



I will endeavor to explain the fact. Suppose a tube, E, 36 feet in length, placed perpendicularly, the lower end inserted in the water, and the upper end attached to a pump, B; the water within the pipe being on the same level as without. The pump being put into operation exhausts the air from the pipe, and the pressure of the atmosphere on the surface of the water, which is fifteen pounds on the square inch, superficially, being taken off the inside of the tube or pipe, the atmospheric pressure on the surface of the water on the outside drives the water up the tube. If the pump is capable of forming a perfect vacuum, the water will rise about 33 feet within the pipe, to C, and less, according to the distance above the level of the sea where the experiment is tried. The reason it will not rise higher is obvious—that as the water is forced up the tube by the pressure of the atmosphere on the surface of the water without, when the column of water equals in weight the pressure of the air on a surface equal to the base of the column of water within the pipe, the power that raises the water is expended, and one balances the other. The pump or piston being above the height that water can be elevated by the pressure of the atmosphere, it is plain that as the water can only rise to E, none will pass through B, the pump.

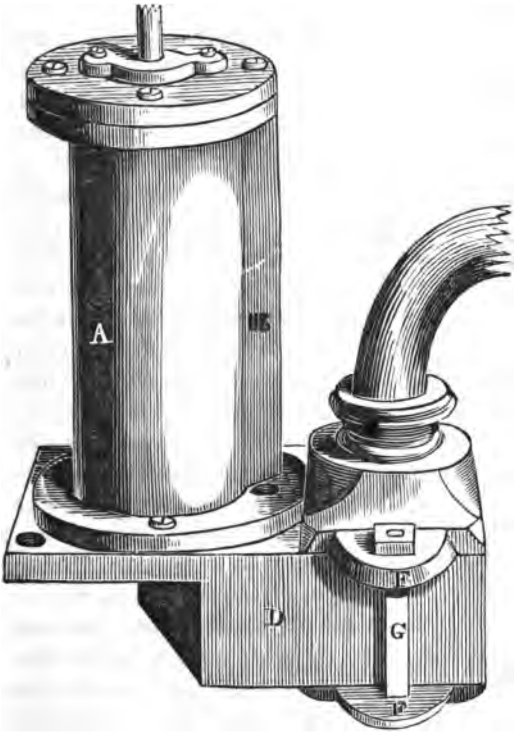


Now suppose we alter the position of the piston of the pump, and place it within 25 feet of the water, and call E the extreme height that atmospheric pressure will raise water, and the pump A 25 feet, it will be perceived that, on working the pump, the pressure of the atmosphere will raise the water to E, and being once raised above the buckets, its elevation no longer depends upon atmospheric pressure, but it is then lifted by the piston or bucket, and the height to which it may be elevated depends upon the height of the tube, the strength of material, and the power applied.

I might here mention an error that exists to a considerable extent among those not conversant with hydro-pneumatic machines, or those depending on atmospheric pressure, that a pump, the working piston or bucket of which is placed 33 feet above the water, will work as well, and raise as much water in a given time as if the working part had been placed at any distance nearer the water. The pressure of the atmosphere being equal to a head of water 33 feet, and as the quantity of water discharged from an orifice in a given time depends upon its elevation or head, it will be understood that the quantity discharged with the head of 33 feet, is more than when it is only 10 feet. Now suppose you have two pumps, one placed 3 feet above the surface of the water, and the other 30 feet. It is apparent that the first will have, when the pump is in operation, 30 feet head (or atmospheric pressure equal to it) to supply it, while the second will have but 3 feet head; therefore the first may be worked with much greater speed than the second, and if the latter be worked faster than the head of 3 feet will supply it, all power applied beyond will be wasted. For this reason, pumps should be placed as near the water, perpendicularly, as circumstances will admit. And I would recommend 25 feet as the maximum under any circumstances.

Many persons suppose that a certain quantity of water raised per minute a given height, requires more power to raise it in a large pipe than in a small one, having, as they say, a larger body of water to lift. Instances are known where larger pipes above the pumps have been taken off, and smaller attached, for the purpose of enabling the water to be raised with less power, as there will be less water above the box to lift. Water presses on all sides alike, according to its perpendicular height. A column of water 100 feet high would press on every square inch superficial 45 lbs. at its base. Now, suppose the area of a piston to be 10 inches, the pressure would be 450 lbs., which would have to be raised in order to discharge the water from the top. If the area of the pipe be 10 inches, the same as the piston, the water will pass upwards with the same velocity as the piston. And suppose the pipe above the pump chamber to be 20 inches area instead of 10, it will be seen that the water need pass upwards with only one-half the velocity as the smaller size to discharge the same amount in equal time. Beyond the pressure of water on the surface of the piston, all we have to contend against is friction, and that is in proportion to velocity. As the water passes up the large pipe with but half the velocity as up the small pipe, it will take less power to raise the same quantity in the same time. No matter how large the pipe above the pumps, the pressure of the water on the piston is no more when the pipe is 12 inches in diameter than when half an inch. Thus the larger the pipe used, both for suction and force, the less the friction, and, of course, a saving in power, strain on the pump and machinery. If any difference be made between the suction and force pipe, the suction pipe should be the largest, particularly when the distance is considerable between the surface of the water and the valves of the pump. Generally, the pumps of my manufacture are calculated to have the openings and connections to take pipe half a diameter of the pump chamber, except when they are required to work rapidly, when they are fitted to receive larger pipe.

DOUBLE ACTING LIFTING AND FORCING PUMPS.



The above cut, representing a pump adapted for nearly every situation for which a pump can be required, is a cylinder, A, and piston. The improvements over the ordinary cylinder and piston pump are the arrangement of the valves and their covers, the bed and side pipe rendering the pump double acting, throwing the same quantity of water at the up and down stroke (excepting the diminution the of piston rod within the cylinder.) Two bolts, G, being removed, all the valves may be taken off for repairs. The valves and packing under the top and bottom cup F, are united in the same piece of leather, and by unscrewing the valve weights they may be removed from the leather, and new leathers cut out by the old ones. The box D, being divided lengthwise, one pair of valves supplies the up stroke, and the other pair, by means of the side pipe B, supplies the down stroke, enabling the pump to keep a constant stream.

The advantages are—1st, The little difficulty in getting at the valves for repairs, while all that is required to repair them is a knife, screw-driver, and leather; and any one who can repair the buckets of a common wooden pump can more readily repair one of these.

2d. The great advantage over single acting pumps is keeping a column of water constantly moving, thereby working more easily, and throwing double the quantity of a single acting pump of the same size,

3rd. By being placed in any required situation, water may be drawn from any distance, and forced any height or distance.

4th. They may be used in all cases for a fire-engine, as the smallest pump will throw water over a two-story house.

5th. They may always be so placed as to be secured against frost.

6th. The friction in a double action cylinder is but half that of a single action, in proportion to the water raised.

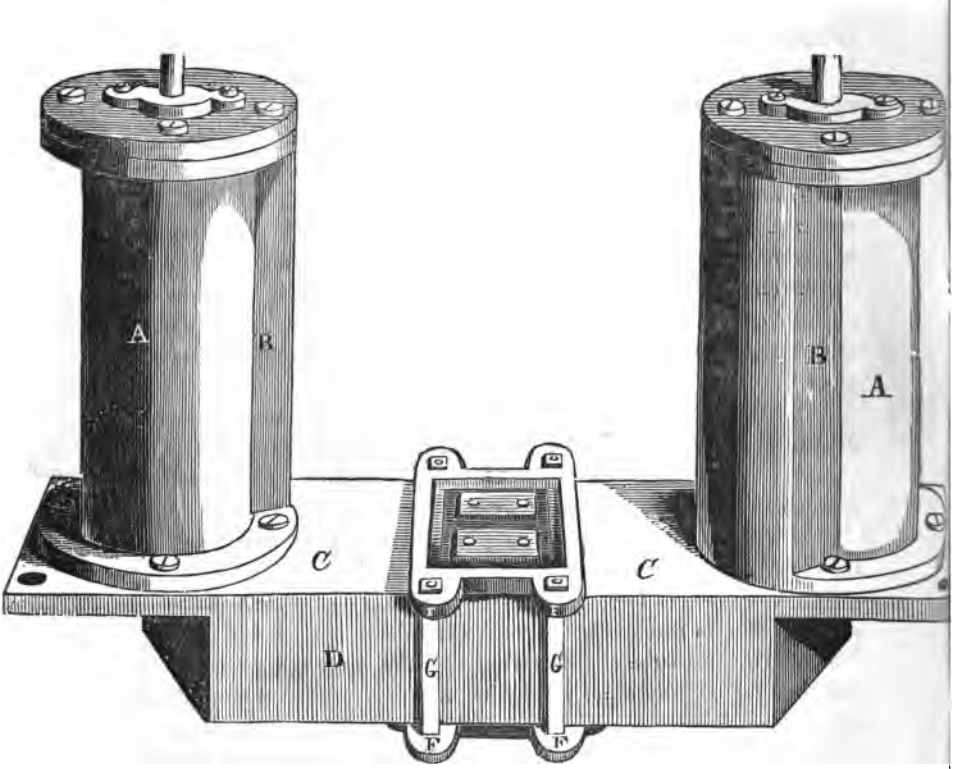
7th, Owing to the simple arrangement of the pump, the price is less than that of any other pump that will perform the same amount of work,

8th, The arrangement of the whole is so simple that it is less liable to get out of order, will keep in repair longer, and is better calculated for situations where mechanical skill is not readily at command, and where the most perfect and efficient machinery is required.

The following cut (page 12) represents two cylinders on one bed. The difference between this pump and the one just described being the extension of the bed, and adding another cylinder. The valves are the same, and both pistons draw in and force out water at the same time.

These pumps are mostly for fire-engines; and the capacity of the cylinders are required to be but one-half the size of those of other engines to throw the same amount of water.

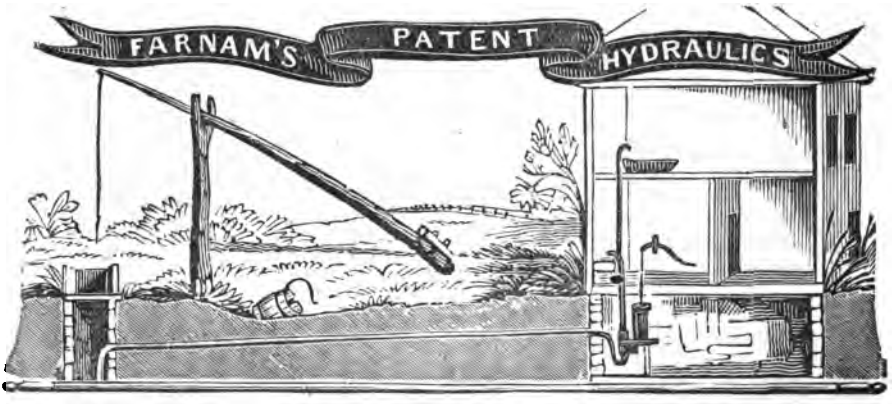
For ordinary purposes, the first described is preferable, having less friction in a pump of the same capacity, the valves are more readily got at for repairs, and one piston less.



The cut on the opposite page represents a pump placed in the basement or cellar, and worked on the floor above, the suction pipe leading from it through the wall and under ground to the well, within 12 inches of the bottom; the discharge pipe leading from the pump to the sinks or basin above, where the water is discharged by a gooseneck, on the side of which is attached, by a coupling screw, a pipe leading to an upper room to supply a bath tub. The same pipe might be led to the upper part of a house to supply a reservoir, from which pipes could be led to any part of the house for shower-bath, domestic purposes, etc.

When working the pump, the pipe at the sink or basin being open, the water will discharge there; but if the water is needed in the reservoir, a cap is made to screw on to the end of the gooseneck, (or a faucet may be used,) which, stopping the water there, it will ascend to the reservoir.

PRACTICAL APPLICATION OF



The pipe being full above the pump, when the cap is taken off, the water will descend with velocity, to prevent which a check-hinge valve is inserted just above the gooseneck to hold the water from descending, or a stop-cock can be used. The standing pipe, if connected with the reservoir at the bottom, may be used as a conductor of water for the different stories through which it passes, by placing faucets where wanted.

When pumps are put up on this plan, if drawing any considerable distance, there ought to be a valve in the suction-pipe a short distance above the surface of the water in the well. The valves I use for that purpose are brass coupling valves, with leather clacks, they being better than the poppet valve, as they leave, when open, a full water way. The poppet valve is so formed that the water strikes against a flat surface, causing more friction than the other, and is not so easily repaired. The wearing part of the clack valve being of leather, may be easily removed, requiring to be done only once in two or three years. The brake is attached to the wall or an up right post: the iron or wooden rod leading from the brake to the piston rod and the pipe passing up at the end of the sink.

These pumps are 2½ inches diameter inside of cylinder, 6 inch stroke, and will raise from 6 to 10 gallons per minute, according to the height the water has to be raised, the horizontal distance making little difference. I have many in operation drawing water from 300 to 1300 feet. Some have been in use seven years.

The following is one of the many certificates that have been given us by those using the pumps:—

Cow Neck, Long Island, February 19, 1844.

This is to certify that I have one of D. L. Farnam's 2½ inch double acting pumps, put up by R. L. W. Moses, which has been in constant use for the last seven years, drawing water from a spring 550 feet from my house where the pump is placed, and raising the water twenty feet without obstructing its operation. I do fully believe them to be the cheapest and most durable pumps (and not liable to getout of order) that can be invented. I have fully tested its utility, and would not be deprived of the use of mine for $1000, if I could get no other of the kind. I do honestly recommend them to all persons, wishing to have their water brought cheap and easily.

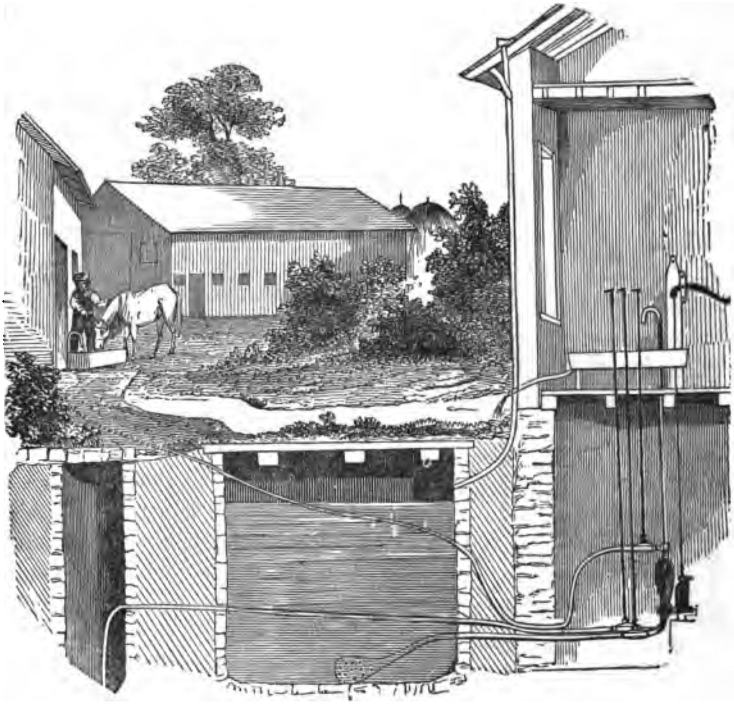
WILLIAM L. BAXTER.

In northern climates it becomes necessary to place tho pump and pipe so as to be secure from frost.

By placing the pump in the cellar, three objects are gained: 1st. Security against frost; 2d. The pump will be better supplied by the pressure of the atmosphere; 3rd. By giving more length of pitman, (or connection between the brake and pump.) the motion is more perpendicular. In many cases it becomes necessary to put the pump down, in order to bring it within the distance of 25 feet perpendicular above the water, which allows a pump to be used in situations where it could not be if placed on the sink or basin.

By attaching hose on to the end of the gooseneck, and a branch pipe on the other end, you have an engine on a small scale, which will throw a three-eights of an inch stream over an ordinary two-story building. The pump next size larger (3 inch, 8 inch stroke) would, in some instances, be better where it is necessary to fill a reservoir, and with manual power; for three resons, 1st. It will discharge double the quantity of water in the same time; 2d. With a longer leverage, a man will work this size nearly as easily as the other; 3rd. When required for the South, and other places where it will be used by laboring men, and receive extra hard usage, I recommend this size, as being stronger, and will stand the extra usage it would receive, and at the same time will be more servicable in case of fire.

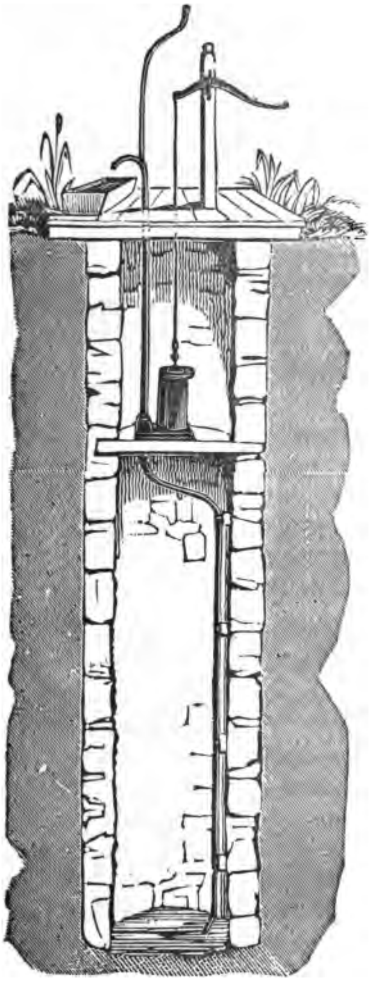
The old adage, "that the weakness of the article is the strength of the trade," will apply to almost any other article save pumps; for the weakness of the article, or the defect of plan, material or workmanship, will soon destroy a man's business.



The above cut represents the form of arranging pipes for the purpose of drawing water from one, two, or more different sources; also the form of conveying the water to out-buildings, for watering cattle, gardens, etc. The branch comes off from the main standing pipe, with a stop-cock in the same, with an iron rod (same as from the stops in the suction pipes) passing up through the floor near the sink. If the place where the water is wanted (outside of the house) be higher than the discharge in the house, then the opening there must be stopped by means of a cap or faucet.

You can draw water from as many different ways with the same pump as you choose, though each branch must have a stop-cock, and of the best make, for a leak would effect the operation of the pump. It may be proper here to state, that no horizontal distance is too great to draw water, and work the pump by hand, if the perpendicular distance between the pump and surface of water be not *over* 25 feet.

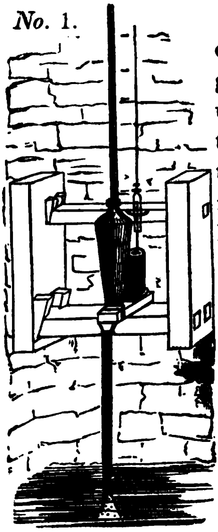
In many countries that is too great, as the atmosphere is higher. In many parts of Mexico, 22 feet is equal to our 33⅓, being the extreme height that water can be raised by the atmosphere with the most perfect pump.



This cut represents a hand-pump placed in a well of moderate depth, not exceeding forty feet, with the supply-pipe leading down the side of the wall, and secured by staples every few feet. This pump is represented as being placed on a stick of timber let into the wall; but this is not a good method, owing to the difficulty of securely fastening in a wall of round stone, as wells are generally built. I prefer fastening the pump on a frame (see cut No. 1, on opposite page,) the cross pieces being fitted into uprights, diameter as great as will pass down the well. When lowered down to its proper place, keys to be driven in at the shoulders of each tennon, driving the uprights against the wall, which, if well done, and the wall strong, will hold all firm. Or the pump may be fastened on to a thick plank or timber, lowered down into the well, and braced against the wall, by scantling leading diagonally upwards and downwards, which being firmly driven and secured into their places, will be sufficiently strong to sustain the action of the pump.

When pumps are required for wells from 40 to 80 feet deep, I use a three inch double acting lift and force pump, (if a force pump is required,) made of sufficient strength to stand the pressure of a head

No. 1.

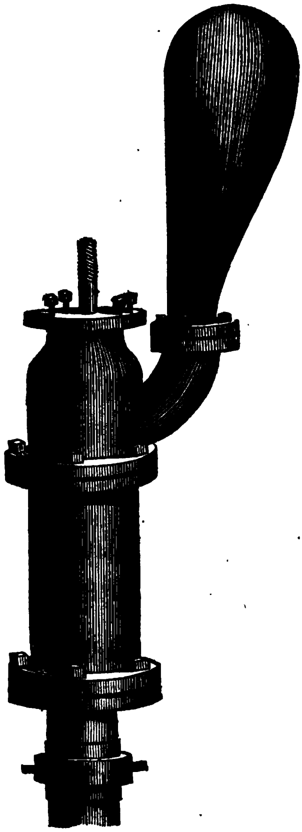


of water 100 feet or more. These pumps will give, with 15 strokes, about seven gallons per minute. Those parts of the pump liable to wear are the valve and piston leathers and packing around the piston rod. The removal of two bolts removes all the valves, and those with the piston leathers can be taken out, and new ones replaced in a few minutes, which requires to be done not oftener than once a year.

These pumps can be worked with a crank and balance-wheel or lever.

When a lift pump is required for wells from 60 to 200 feet, I use one as represented by the annexed cut, of the following description:—

It consists of a cylinder five inches diameter, 10 inch stroke, bolted upon a bed-piece, which contains the lower valve, from which (the bed-piece) projects a tube calculated for three inch pipe of lead or copper, and connected by a coupling screw. The heel of the cylinder is formed of a globe top, connected to the cylinder with bolts, the top of which is intended for cut iron pipe with flanches, and bolted together, or can be arranged with a cap end, as is usually used in city water works for conducting water.



I prefer iron pipe with flanches, as it is more easily put up, the joint being made with leather, and secured firmly together with bolts.

From the side of the top cup projects a tube for the purpose of connecting a copper air chamber, which tends to keep the upward column of water in motion while working, thus enabling the pump to be worked with less power.

In ordinary lift pumps, the column of water stops at every down stroke of the pump, and every up stroke has to act against a column of water at rest.

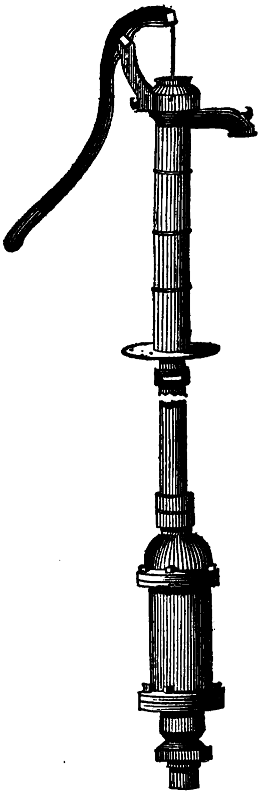
In the chamber is a brass bucket with a leather hinge valve, (the lower valve is in like form held in its place by the cylinder being bolted to the bed-piece,) and connected to the pitman by a key, the pitman passing up the inside of the pipe to the top of the well.

These pumps are of a most durable character, being entirely of metal, save the valve and piston or bucket leathers, which are the only parts liable to wear. When they are put up they can be set on to a wooden frame, as is represented on page 17, cut No. 1, (unless preferred to be fastened to an upright post, which is readily done,) having a hole cut in the lower cross-piece, sufficiently large to pass the suction-tube down through, letting the bed-piece rest upon it. 2d. Connect your suction-pipe below by means of the coupling, having a leather washer in it to make a perfectly tight joint, then put two or more braces across the well, so as to hold the pipe steady, and remove the weight from the coupling and parts above. 3rd. Remove the top cap, and put the piston or bucket into the cylinder, then pass the top cap over the rod, and bolt it into its place. 4th. Connect the air chamber to the part intended for it, and carry up the pipe and pitman to the top of the well, having at that point a head with a spout that will convey the water to any point required, and the pitman connected to the power. Be sure and have the pipe perfectly plumb, and so braced by cross pieces every few feet that the pipe will be held firm in its place, at the same time taking off the strain from the parts below. Whenever the bucket and lower valve require examining, it is only necessary to disconnect the pitman from the power, and draw it up, bringing the bucket into the globe top ; then, by unscrewing the bolts that hold the cylinder in its place, it can be removed, (the braces above holding up the delivery pipe,) when the lower valve can be removed with ease. If the piston is out of order, it is only necessary to drive out the key that holds it fast to the pitman, and unscrew it, and you may repair all damages.

S. Selegman, Esq., of Jamaica, L. I., has one in his well 140 feet deep, worked by one horse, that was put up in September, 1845, the design of which was somewhat different, but the principal the same. So far it has given *perfect satisfaction.* It is worked daily, giving 15 gallons per minute.

This pump is intended to be worked by power, though it can be arranged for manual labor

Price of the above pumps, of brass, including air chamber, ready to attach the pipes and pitman to, $90.



The annexed cut represents a cast iron lift pump, for family purposes, for wells of 15 to 33 feet deep. The chamber bucket and valves are some seven feet below the ground or top of the well (bringing the distance to raise the water by atmosphere 26 feet) and lead pipe used below.

If they are placed out of doors in cold climates, *they will not freeze.* If they are desired in houses, and the chamber can be passed, down through the floor, bringing the perpendicular distance within the required measurement, they will work just as well, as the horizontal distance of the pipe makes no difference save in the friction of the water passing through it.

If for any greater depth of well, the chamber can be carried down, inserting one or more lengths of two inch cast or wrought iron pipe, (it going together with coupling screws,) and lengthening the pitman, which is of wrought iron. I can arrange them complete for any depth of well.

The same directions may be followed in putting up these as are laid down on page 17, under head of deep well pumps.

I have two sizes, a three inch cylinder and four inch cylinder, eight inch stroke

Price of three inch cylinder, as shown in cut, seven feet long, wrought iron brake, $15.

Price of four inch cylinder, as shown in cut, seven feet long, wrought iron brake, $21.

Price of four inch cylinder, as shown in cut, seven feet long, wrought iron brake, brass cylinder, complete, $33.

When a cheap cistern pump is wanted to raise water from 10 to 15 feet, an iron pump of the description here shown answers a good purpose. The first cost is small, and with one and a quarter inch

lead pipe they work very well. Most of them are so arranged that by raising the brake to its extreme height, the valves are opened, and the water runs back into the cistern. The objection is, when they are put up exposed to the weather in northern climates, the brake is generally omitted in *very* cold weather, from haste to get into warmer quarters, and the pump probably ruined. They should, therefore, be put in the house, where the liability to frost is not so great.

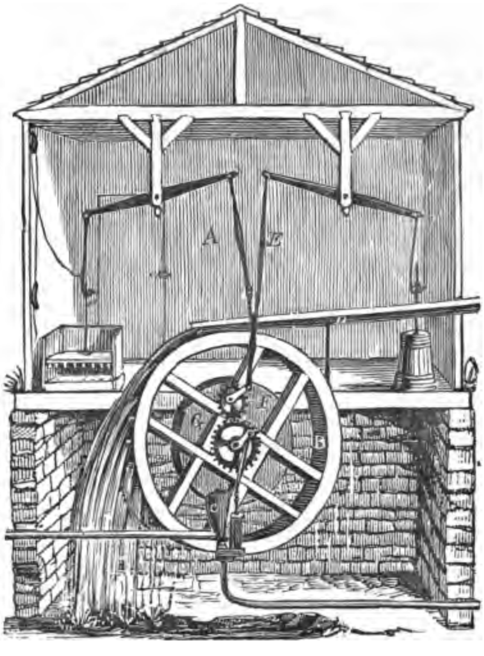
The pumps previously spoken of being for wells and springs, and calculated to supply the ordinary consumption of families‘ I will introduce the plan of obtaining water from springs or streams by mens of pumps worked by water wheels.

PUMPS WORKED BY WATER WHEELS.

The cut on the opposite page represents a sectional view of a small building covering a water wheel. To the shaft of the wheel a crank is attached, connected by a shackle bar to the piston rod of the pump. The shaft on the opposite side of the wheel carries a grindstone; above, to the right, is a churn; to the left, a box for cleaning clothes, to which is attached a steam apparatus.

The cut represents the works of Winthrop Phelps, Esq., of Chatham, Columbia County, New-York, put up in 1839, a description of which is given by Mr. Phelps in the "Cultivator," vol. vii. No. 2, as follows :—

" For the benefit of those farmers and others, situated as I have been, without the convenience of good water near the premises, I would state, that in November, 1839, I engaged Mr. D. L. Farnam, of 247 Water-street, New-York, to put up an apparatus that should enable me to have water at my house, barn, etc. I had a spring of excellent water 400 feet from the kitchen, that disharged 30 feet lower than my house. I had, in the meadow above the house, several small springs that discharged together a small but constant stream during the year. The plan was to use the water of the latter to force up the water from the spring to those places where I wanted it. For this purpose, I put up a building 12 feet square, standing on a stone wall about five feet high. This building was placed about 200 feet from my house, on the low ground between the spring and house. In this I put a water wheel nine feet diameter and 12 inches wide. The water was brought along the side hills from the upper springs, and, by a spout carried on to the wheel. An inch lead pipe was laid from the spring to a small double-action pump, attached to the wheel shaft by a crank, as seen in the cut, thence leading under ground to a reservoir adjoining my milk house, within 20 feet of the



kitchen door; from this reservoir a pipe leads to the kitchen, and discharges into the sink by a cock. From the reservoir I convey water on to the shelves in my milk room, they having a raised edge, so that at pleasure I have water running one inch deep on each shelf, to keep the milk cool in warm weather. Likewise from the reservoir I have a half inch pipe laid to my barn yard, 15 rods farther, and a pipe running to the hog-pen, keeping a constant supply. Attached to the water wheel is a grindstone, and machinery to do our churning, which we have used through the season. The apparatus marked A is a plan I intended for pounding clothes. With the addition of a steamer, it would save much labor to the women, and the same steamer might be used to steam hay, potatoes, corn, etc. for cattle and hogs. My water works continued to work well all last winter, without in the least being affected with frost. The quantity of water to work the wheel was small, the whole of it coming from a few springs in a meadow some 300 feet from the place to where it was conducted to the wheel."

Running streams, where a head of three feet can be had, with 50 gallons per minute, will answer to raise one gallon of water per minute up a perpendicular height of 100 feet.

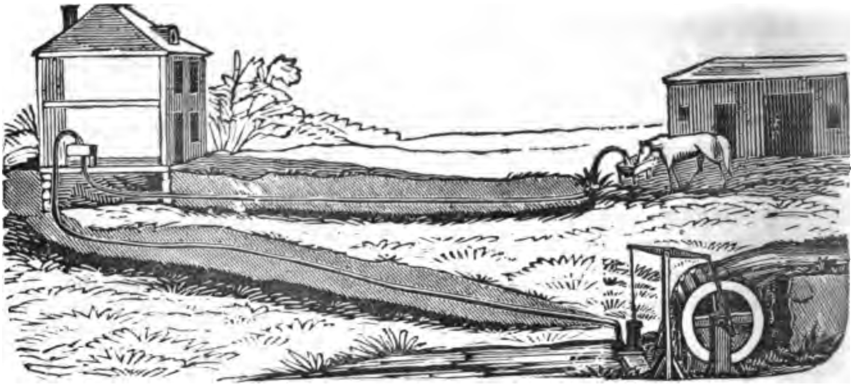
I have put up a pump forcing water through 380 feet of pipe, 40 feet rise, and a head of 30 inches with the water of a small brook, giving six and a half gallons per minute at the place of discharge. When the quantity of water is small to work a wheel, the quantity raised will of course be proportionally less; but one gallon per minute amounts to 1440 gallons per day. This amount conducted into a reservoir to be drawn for domestic purposes, will furnish an ample supply for keeping clean clothes and faces for a pretty large family. It is not necessary that the spring or source from which the water is drawn should be in the immediate neighborhood of that to be used as power, as the water to work the wheel may be conveyed in many cases to the vicinity of the spring, or, by pipes, the water brought to the pump. In some instances, the water to work the wheel and supply the pump can be drawn from the same source, when the quality of the water is satisfactory. On the next page I give a table of the quantity of water that can be raised or forced up by using a water power and wheel.

The variations in the quantity of water in different situations, likewise in the fall and height required, would render a table to answer all purposes too lengthy. The following, however, is an easy method by which to ascertain the required quantities. Multiply half the diameter of the water wheel—if overshot, or the fall of the water if breast wheel—by the quantity of water the fall will give per minute, and divide the product by the height the water is to be raised, and you will have the quantity of water the fall will give, without making any allowance for friction. What that ought to be depends on the qualitiy of your machinery, the arrangement, the size of pipe, and the distance horizontally the water is forced. One-third less than the quantity found by the figures is perhaps the best data;—

Supply of power. Galls. per minute.	Fall.	Feet to be raised.	Gallons per minute.
50	5	40	6¼
60	6	40	9
70	7	40	12¼
80	8	40	16
90	9	40	20¼
100	10	40	25
110	11	40	30¼
120	12	40	36
130	12	40	42¼
140	14	40	49
150	15	40	56¼

Persons having small streams of water that they can make a temporary dam across, and insert at the top a spout that will let *all* the water pass through it, may by having a hogshead, box, or tub placed under the spout, determine the quantity the spring or stream will give per minute. Or when the stream is too large to be managed as above, and not too large to be contracted to pass through a spout or floom—of any width, so that the bottom will be level and the sides perpendicular—take the depth of water, the width of spout or floom, and multiply them together, and get the number of feet the water moves per minute, then you can find the number of cubic feet of water that passes per minute. A cubic foot of water weighs about 62½ lbs., and contains 7½ gallons, wine measure.

The velocity of the water will be rather more in centre on the top than an average, so it ought to be tried near the edge and centre, dividing the difference. A cork with something suspended reaching near the bottom, will answer to determine the velocity.



The above cut represents a pump worked by a wheel kept constantly turning, conveying water to a building, thus doing away with the necessity of a large reservoir. The water is discharged into the small reservoir from the end of the pipe. To prevent the reservoir overflowing, a pipe passes out from the bottom, leading to the barnyard, or any place required, the pipe passing through the bottom of the tub, (and not, as represented, by a gooseneck over the top,) raising within the level of the same nearly as high as the water is required in the reservoir.

The above plan is only intended to show the general design. The details of arranging the whole to the best advantage are contained in other parts of this work.

It will be perceived that a walking beam is used to work the pump. When the wheel is small, and there is not room to put the pump below the crank, a walking beam becomes necessary, unless it be preferred to place the pump horizontally, or at any angle required, in which case the air chamber must be made to suit the situation, as it is required to be perpendicular. The pumps will work equally as well in a horizontal, diagonal, or perpendicular position.

The following letter is from C. N. Bement, Esq., well known for his improvements in agriculture, farm stock, etc., and as author of that valuable work, "The American Poulterer's Companion." I insert it, knowing that those acquainted with him will have full confidence in his opinion:—

BEMENT'S AMERICAN HOTEL, ALBANY, Nov. 29, 1845.

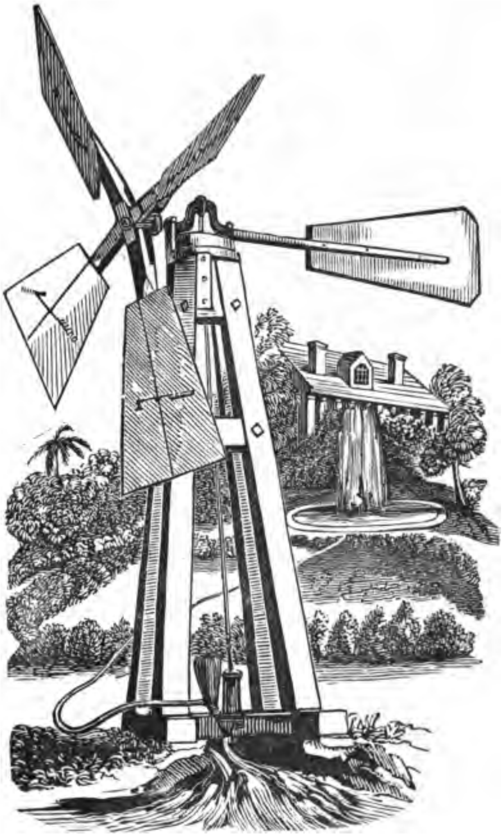
D. L. FARNAM, ESQ.

Dear Sir: In reply to the inquiries contained in your note of the 27th instant, I have only to say, that it is now more than four years since I put one of your smallest sized double action pumps in operation at my Three Hills Farm; and so far it has given good satisfaction. It is worked by a water wheel five feet in diameter, buckets 12 inches, and throws up over 2000 gallons per day—54 feethigh, and 700 feet distance.

It has never been out of order, except by accident, and the wearing out of the packing. The leathers round the piston have been renewed twice, and the valves once, in four years. I can, therefore, with confidence safely recommend it as being well calculated for raising and forcing water, and as durable, and less liable to be put out of order than any pump that has fallen under my observation.

I have no doubt, with the power I use, it would discharge an equal quantity of water twice the height and distance it now does.

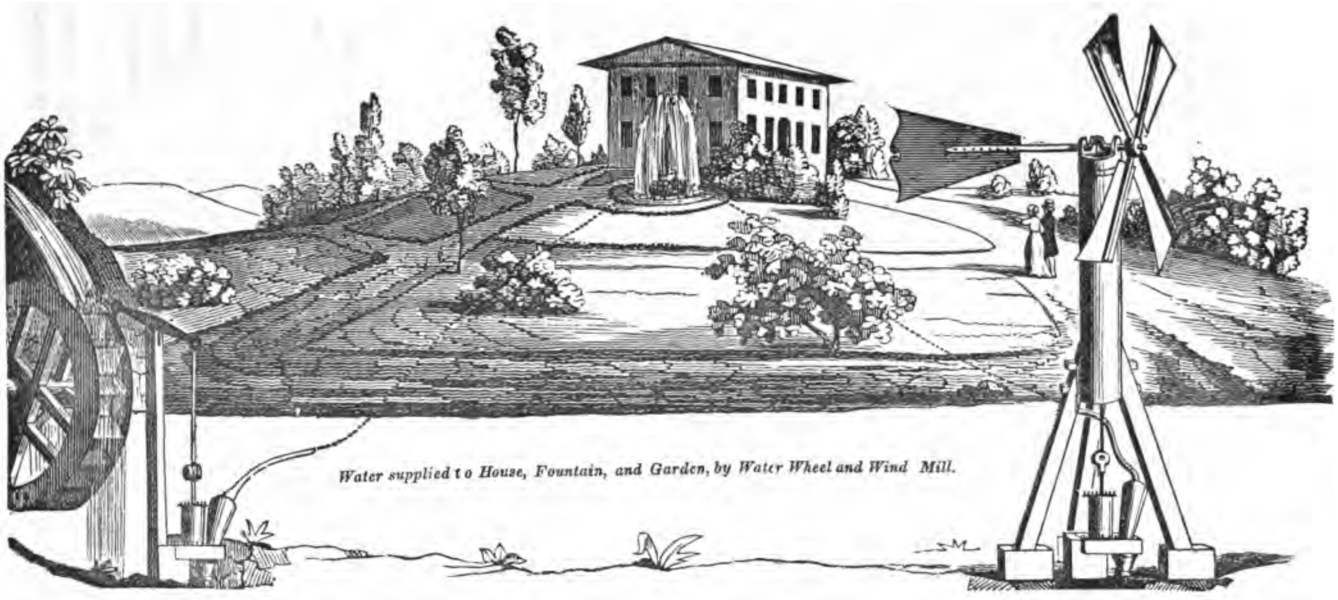
Respectfully, yours, C. N. BEMENT.



The above cut represents a wind mill working a pump forcing water from a spring to a fountain. A fountain would not play very steadily depending upon wind alone for its power; but the engraver took a "short cut," and left out the reservoir.

Wind mills may be worked to advantage in many situations where nothing better can be had. I have found, with a reservoir of three times the capacity of what may be wanted for a daily supply, there would be, with a wind mill of sufficient size, little danger of being out of water. These mills work on two rings, the inner one being attached to the post or frame, and the outer one revolves on it, with the crank, shaft, and boxes. The arms that support the wings are of cast iron, keyed upon the shaft, and the wings bolted on to them. The vane arm is bolted into a flanch attached to the outer ring.

The great objection generally to a machine being worked by wind is the unsteadiness of the power, varying from a stand still to the greatest velocity, at which speed it is liable to injure any machinery attached to it, and to have a man attending to it would be expensive. I make the wing with joints, according to the lines seen in the cut. The projecting half of each wing is sustained in its position by hinges and springs, which yielding to high winds, it is brought to more or less angle to the other half, thus modifying the velocity and preventing too great a speed. When the wind is not so strong, the springs draw the wings to their places, and they "go on their way rejoicing"



Water supplied to House, Fountain, and Garden, by Water Wheel and Wind Mill.

In the foreground of this view is seen a small mill fixed on top of a pump log. The rod passes down the centre, and is connected with a double joint a few feet below the crank, (so as to allow it to vibrate and revolve, from which (the double joint) the rod continues passing through a guide, and connecting with the pump.

Machines of this kind must be kept well oiled, or they will wear out fast. I place cups for holding oil over each box;

the oil supplied by lamp wick, and the cups holding a gill each, which will last from eight to ten days.

In July, 1846, we put up a wind mill for Samuel Hunting, Esq., Sag Harbor, Long Island, to work a five inch pump, raising water from a well 25 feet deep, and forcing it into a reservoir for the purpose of supplying his dwelling house, fountain, etc. A letter written by him states that the mill had raised 3,250 gallons 40 feet in one hour.

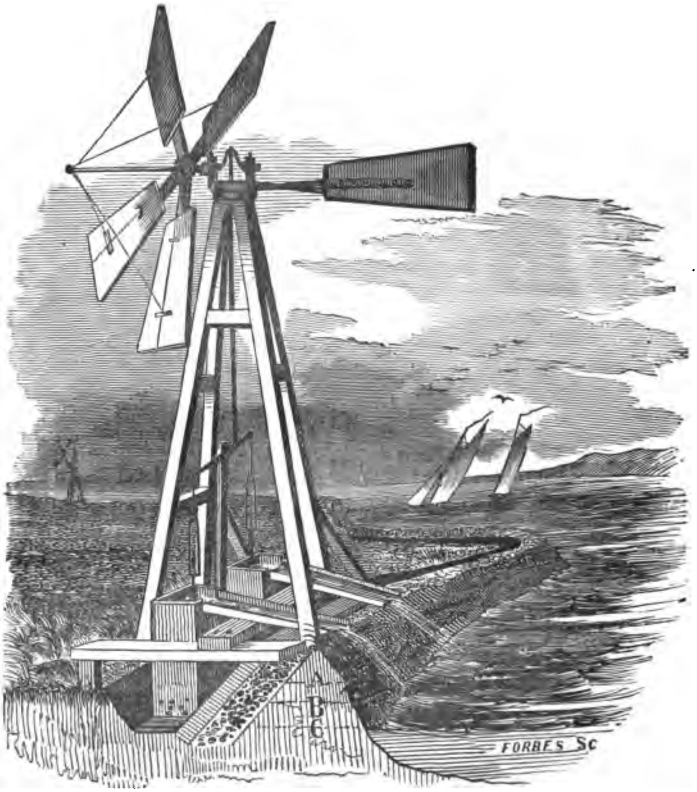
These mills would do well on a farm for raising water from wells or springs for the supply of cattle or stock, a basin being prepared on the surface of the ground, and puddled with clay to hold the water. They are used for raising water for tan works, turpentine distilleries, salt works, irrigation, etc.

DRAINING LOW LANDS.

This subject is important, not only to those having low lands, but to the public at large, as millions of acres of as rich land as the best in the country—land for many feet below the surface, composed of vegetable mould—are now of little or no value, or only used to grow an inferior kind of grass. In many situations, a small per centage on the increased value would pay the expense of ditching and dyking; and these are often done imperfectly, for the sole purpose of securing crops of inferior grass, when a little more outlay would make the land fit for any farming purposes; to accomplish which, the dykes or embankments, generally, ought to be made entire water-tight, without sluice ways, and secure against the depredations of musk rats or other vermin, (the great enemies of water embankments,) by facing with gravel, and covering the gravel or sand with the soil taken from the ditch.

In the following cut, (page 29,) the dots between the two parallel lines represent the gravel. The letter C marks the line of low tide; B, high tide; A, spring tide, which, but for the dyke, would overflow the land. Musk rats or other vermin will not dig in gravel; and a broken dyke that lets in salt water on land under good cultivation is a serious affair. It is a matter of economy to have the work well done in the first instance.

Draining by Wind Mills.—Respecting the draining of lands, after the dykes are well secured, so as to keep out the salt water, it becomes necessary to adopt some plan to get rid of the superfluous fresh water from springs, streams, or rains. To do this, I would recommend one or more wind mills; two mills are best in all cases—should any accident happen to one, the other will prevent injury while the damage is repairing. As the height at which the water is to be discharged over the dyke would be small, the best pumps for the purpose would be plain cylinders; if of wood, made square; if of copper, round. Two pumps would be necessary for each mill, that the up and down strokes might be equal.



The rod from the crank may be attached to the walking beam for working both pumps, as seen in the cut.

Mills for this purpose are used in Holland, where the sea is often higher than the land; also in England, and more or less in other European countries.

HORSE POWERS.

In many situations a horse power can be made very useful. A person wanting a large quantity of water for daily use (domestic purposes, bathing, green houses, watering gardens, cattle, or for fountains, etc.,) can raise in a short time into a reservoir a large quantity of water by a horse power. It will be found that the time occupied by a man and horse for one hour in a day, or once in two or three days, will be but a trifle compared with the advantage arising from having plenty of water.

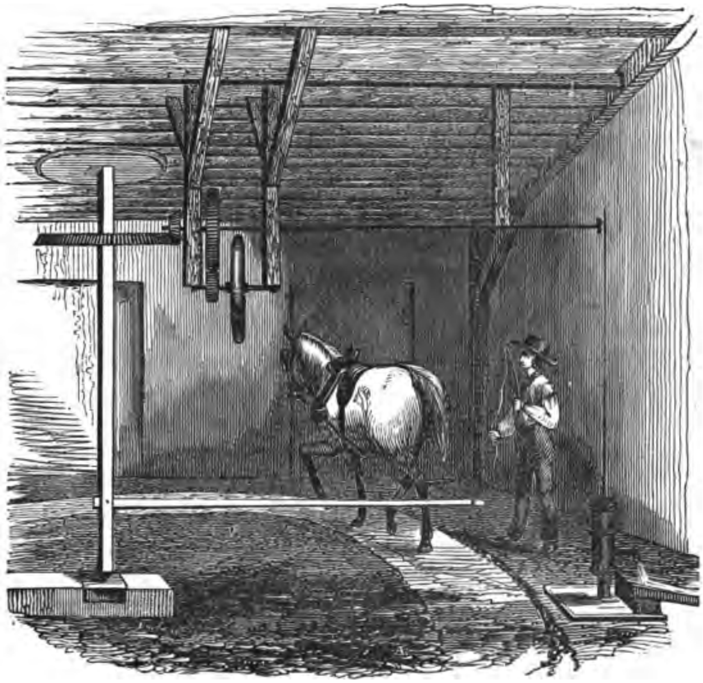
TABLE *showing the quantity of Water raised by one Horse per minute and per hour, from one foot to 50 feet.*

Feet.	Gals. per Min.	Gals. per Hour.	Feet.	Gals. per Min.	Gals. per Hour
1	4,125	247,500	26	158.6	9,519
2	2,062	123,750	27	152.7	9,166.2
3	1,375	82,500	28	147.3	8,839.2
4	1,031.2	61,875	29	142.2	8,532
5	11,825	49,500	30	137.5	8,250
6	687.5	41,250	31	133	7,980
7	589.5	35,357.1	32	128.9	7,734
8	515.6	30,937.5	33	125	7,500
9	458.3	27,499.9	34	121.3	7,278
10	412.5	24,750	35	117.8	7,071
11	375	22,200	36	145	6,873
12	343.7	20,625	37	111.4	6,688.8
13	317.3	19,038	38	108.5	6,514.2
14	294.6	17,678.5	39	105.7	6,342
15	275	16,500	40	103.1	6,186
16	257.8	15,468.6	41	100.6	6,036
17	242.6	14,558.4	42	98.2	5,992
18	229.1	13,749.6	43	95.9	5,775.8
19	217.1	13,026	44	93.7	5,625
20	206.2	12,375	45	92.7	5,556.2
21	196.4	11,785.2	46	89.6	5,380.2
22	187.5	11,250	47	87.7	5,265.6
23	179.3	10,764	48	85.9	5,155.8
24	171.8	10,312.2	49	84.1	5,050.8
25	165	9,900	50	82.5	4,950

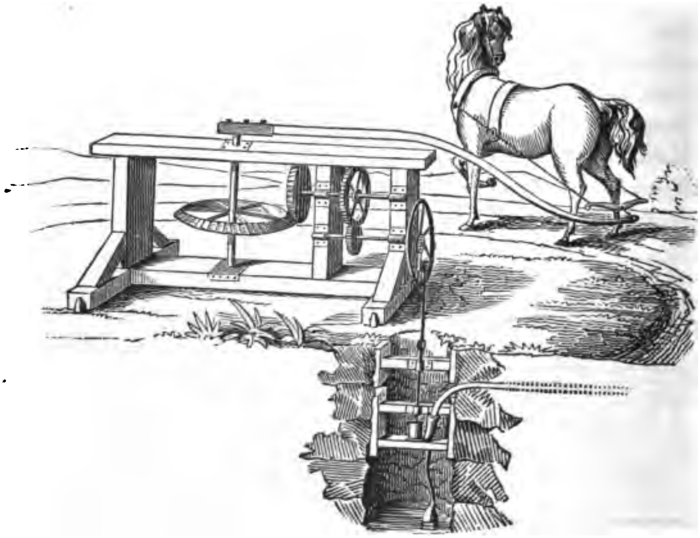
Having a pump of sufficient capacity for two horses, the same quantity of water can be raised in half the time that one can do it; but one horse can work the same pump as easily as a smaller one, if the stroke of the pump be shortened so as to bring the quantity of water within his power, which can be readily done by having the crank pin so fixed that it may be taken out and placed in a hole prepared for it near the centre, so as to give the requisite shortness of stroke.

Horse powers should be strong in every part, and the work well made, as all unnecessary friction is so much loss of power. To work a pump, they should in all cases have a balance wheel to regulate the motion, as without one the draft is unequal, and the jerking produces unnecessary wear to both machinery and horse—while unequal motion, being more liable to break the parts, calls for more strength in them, consequently extra expense.

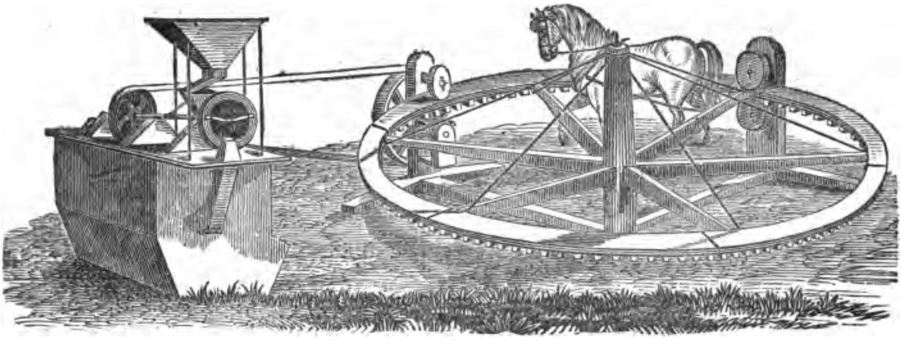
Machines to work pumps are generally calculated to be stationary, and can be maed on a more simple plan than those intended to be movoable.



The above cut represents a horse power inside of a building with the running geer fastened to the floor above, the upright post having each end ironed for the purpose of running in cast iron boxes above and below, with the pole running off to connect the horse to. It may be simplified by putting a large heavy balance wheel on the horizontal shaft, doing away with the small balance wheel, shaft wheel and pinion. This would form a horse power on the most simple and efficient plan.

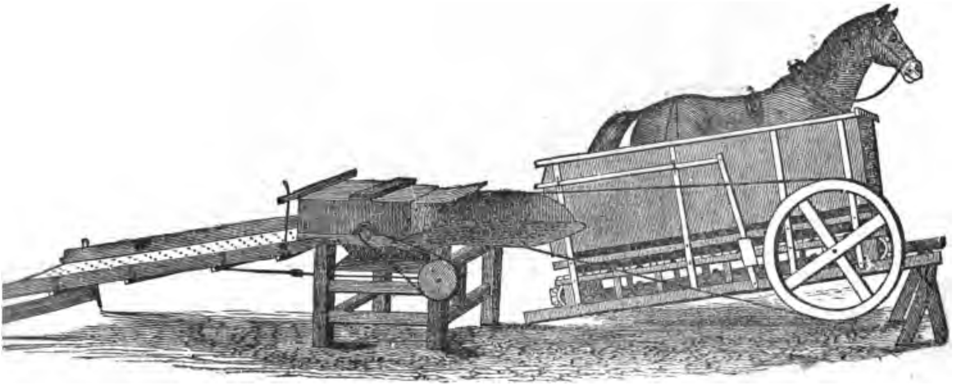


Above is another plan of a horse power, which may be preferable in many situations. The drawing is incorrect in one particular: the balance wheel which is represented outside of the frame ought to be between the posts, and the pitman to connect the pump with the machine, ought to be attached to the crank on the upper shaft; because the speed of the balance wheel on the shaft, as represented, would be too quick for the pump. The circle for a horse to travel in, to work to advantage, ought to be 25 feet diameter, and a horse will pass around on an average about three times per minute. In order to get 25 revolutions to the crank, the large wheel must be eight times as large as the small one, or eight feet and one foot, if of cast iron; but if made on the plan as represented on page 31, the large wheel may be made of wood, with iron segments. In that case it would be well to make the large wheel 12 feet and the pinion 18 inches, as the friction is less when the pinion is large.



The above cut represents another form of power, very simple in its construction, made entirely of wrought iron and wood, with the exception of the pinion which is of cast iron. Many prefer this power to all others, although it occupies more room. It consists of a wooden rim or circle of 20 feet diameter, to which, on the under side, is attached a wrought iron rim in segments bolted to the wooden rim, and that geared into the pinion wheel, which moves the machinery. The horse travels on the inside of the circle; and the power is so arranged that one or six may operate.

The cut below represents a power termed the " Railway Horse Power." They are arranged for one or two horses, by increasing the width of the rotary platform, and allowing them to work abreast of each other.



The powers described can be so arranged that when not in use for raising water they may be used for many other purposes. In grinding coarse fodder, cutting corn stalks or hay, straw, churning, grinding apples, turning grindstones or lathes, boring fence-posts and holes, sharpening rails, sawing wood, etc.

Prices of Taplin's horse power:—

Price of railway power for one horse, $ 80 to $100.
" " " " two " $100 to $120.

PUMPS FOR FACTORIES.

As an introduction to the subject of pumps for factories, I here insert a letter received from Robert Rennie, Esq., of the Lodi Print Works, near Belleville, New-Jersey, who has twice saved his factory from fire by means of a pump fitted up for that purpose. He has 150 feet of hose, and a branch pipe that will deliver one and a quarter inch stream. He has had several others from us, and all in operation; one working by a wind mill:—

MR. FARNAM:

Dear Sir:—In reply to your inquiry of how I had geared the pump I bought of you four years ago, I enclose you the accompanying sketch of the fixtures. By moving a wooden arm, I can put it in gear instantly. I have had occasion to use it twice since I put it up, and in both instances it saved a large amount of property. I work it 60 double strokes per minute, that is, the crank makes 60 revolutions. I can throw a stream of water out of a one and a quarter inch nozzle over my highest buildings, 50 feet high.

I use it occasionally to see if it is in good order, and in no instance have I found it fail, but at all times fit for duty, if kept free from sand or gravel under the valves. I have also less difficulty in effecting insurance now than previously to getting the pump.

I have much pleasure in testifying to this, and I hope it may be of some service to you. I do not think any considerable factory should be without one.

I am, yours, etc.

ROBERT RENNIE.

Lodi Print Works, N. J., Feb. 19, 1845.

In November, 1849, I furnished Charles A. Platt, Esquire, of Augusta, Georgia, with a six inch pump (24 inch stroke) to supply his factory with water, and to be used in case of fire, etc. The distance he draws his water is some 23 feet perpendicular, and 25 feet horizontal, through a four inch copper pipe which I furnished him, with all the apparatus pertaining to it. Unavoidable delays prevented him from getting the pump up until May following, at which time I received from him the "Daily Constitutionalist," bearing date Augusta, Georgia, May 26, 1850, with the following:—

We yesterday afternoon witnessed the test of the new steam fire pump just added to the establishment of our enterprising fellow-citizen, Charles A. Platt. We were pleased to see present several of the fathers of the city, who we hope will carry out the wishes of Mr. Platt, and build a large cistern on Ellis-street, in the rear of his manufactory, to be used in case of fire in the neighborhood.

By the use of this pump, he can throw two streams of water through a large sized hose over his three-story building; and by attaching the city hose, can convey two streams as far as the hose will reach. In case of fire, this pump will do better execution than half a dozen common engines; and Mr. Platt deserves the thanks of the community for the expense he has been at in its erection.

By invitation, the members of the Phœnix Engine Co. (one of the best in this city, and of the newest make) tested its power yesterday afternoon in furnishing a supply of water. Although well maned and worked, it occupied less than one minute, with one leading hose, to overrun her with water. At any hour of the night steam can be raised, and put the pump in working order in the short space of ten or fifteen minutes.

A letter from him in June, states: "The pump continues to improve every trial, and gives general satisfaction to all who have witnessed it in operation."

In September I forwarded the balance of suction-pipe (as a branch to lead into a public cistern) with the stop-cocks connected, which in part carries out his wishes for the public good.

The greatest number of revolutions that the pump was making at the time of the trial was 30.

Factories may be insured, but no one expects to obtain by insurance the full amount of damage for loss of business, etc.: and when supplied with proper machinery to guard against damage by fire they may be insured for a small amount, sufficient to cover any probable damage, or obtain their policies at a much reduced rate. Either way a great saving will be made.

There are a variety of methods to arrange the machinery for the purposes intended. I have had pipes connected with the pump leading perpendicularly up within the building, and openings in each loft, and a coil of hose and pipe hanging by the same, to be used when required. In other cases, the water is raised into a reservoir, formed for this purpose on the high ground near by, and fire plugs in front and rear of the buildings to connect hose. By means of ladders alongside of the building, several streams might be thrown into any part of the building. The ladders can be arranged permanently against the building. A reservoir of a proper elevation containing 50,000 gallons, with the operation of the pump, would be sufficient to put out any fire in the building, even if well under way. One is in operation on the above plan for E. Gray, at Ellicott's Mills, Md., raising 75 gallons per minute 150 feet high into a reservoir on a hill in the rear of his factory. The pipes are connected with two fire plugs in rear and one in front.

Mr. Rennie's plan of using merely the pump and hose direct has been found efficient in two instances. He states, that being in bed, in three minutes from hearing the fire-bell he had water on the fire, and extinguished it in a few minutes.

I give below items of the cost of an apparatus fitted up for a mill in Oswego, by which correct estimates may be made for the expense for any situation.

One six inch double-acting pump, frame and air barrel,	$150 00
63 feet, three inch cast iron pipe, at 37½ cents,	23 63
Two elbows and two T, 150 lbs., at 4 cents,	6 00
Five brass screws, caps, backs, and bolts, to attach to the iron pipe, for hose connection, $4,	20 00
150 feet hose, three lengths, 65 cents, three pair couplings,	103 50
Bill for gear wheels, shafting, and fitting up the pump ready to run,	50 00
50 lbs. lead, for joints, at six cents,	3 00
Six days' time, fitting up pipe, etc., at $2.50,	15 00
Boxing, cartage, and freight,	3 87
	$375 00

On the next page is a correct representation of a six inch pump, 12 inch stroke, double action, on a frame such as is usually put up for fire-engines for factories, mills, etc. Price, as seen in drawing, $150.

The only material difference between this and smaller pumps is in the manner of getting at the valves. As iron pipe is generally used for these pumps, it would be more difficult to get at the valves, to obviate which, the openings are covered by caps E E, on the removal of which the valves may be taken out in front.

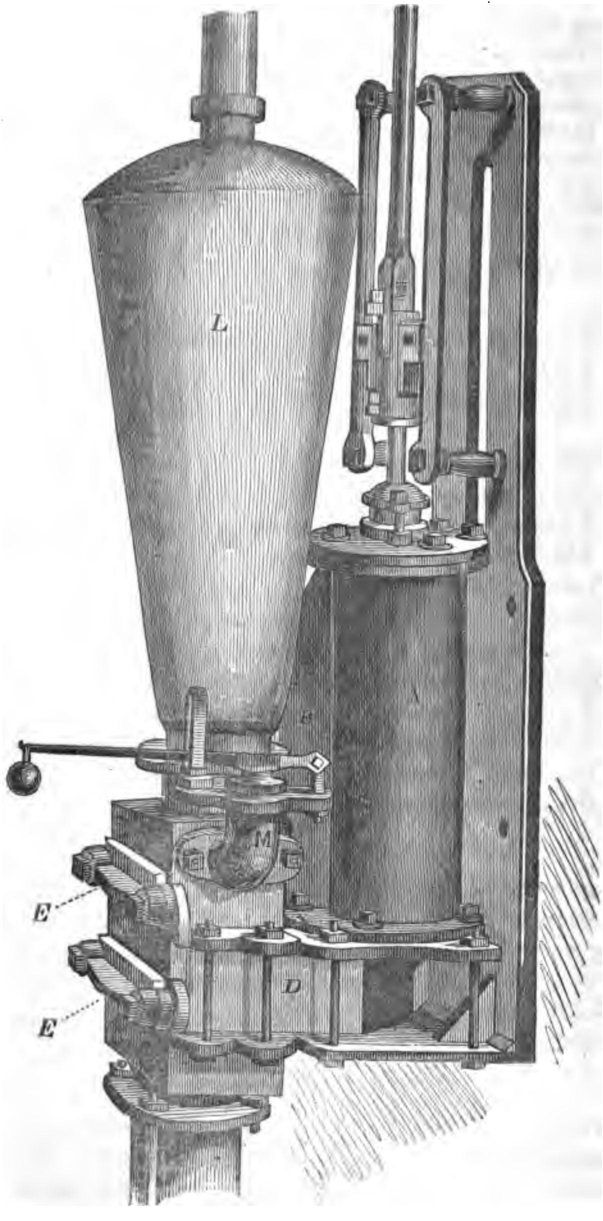
The safety valve, M is added to prevent bursting hose or pipe. In case of fire, the power moving the pump may be applied suddenly and powerfully, and before the water can have time to move the whole length of the pipe, (or hose when it is used) a person holding their thumb over the branch-pipe nozzle, (there being no other outlet,) the pipe or hose might be burst. To prevent damage from such, cause the safety valve has been added.

PAPER MILLS.

A large number of paper mills have put up pumps of my manufacture—generally six inch. All have been so fitted up as to be used for drawing and raising water from the settling basin, or from springs, and to be used in case of fire. Where pulp is to be raised, these pumps answer the purpose, without its clogging or interfering with their working.

TAN WORKS.

I have many in operation for tan works, for drawing water and raising the tanning liquor to the leaches, after passing from the vats to the cistern. Two pipes pass from below the pump, one into the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water fountain, and one into the cistern, each pipe having a stopcock, so you can either draw water or liquor. Pumps for this purpose ought to be of brass, as iron colors the liquor. They are worked variously, by wind mills, horse, water, or by hand.

In July, 1848, I fitted up for Messrs. F. J. Prentiss & Co., Newbern, N. C., a four inch brass pump, metallic valves and piston, with four supplies and four discharges, worked by steam at 50 revolutions per minute, giving perfect satisfaction.

BREWERIES AND DISTILLERIES.

These pumps are admirably calculated for forcing water through pipes for cooling the beer, as well as raising water for the ordinary supply, or for pumping all the liquids that may be required, charging stills, worms, etc.

SOAP BOILERS.

I have supplied soap boilers with pumps for raising hot ley. When they are used for this purpose, they are made without any leather, and calculated to withstand any boiling liquid.

HOT WATER.

Pumps for bathing, or other purposes requiring hot or warm water, are made in the same way as those last named, all of hard metal, except the joints, which are of canvas or India rubber.

MINES.

Pumps for mines ought to be of the most simple and efficient kind. The valves should be so arranged that in a few moments they may be taken out and new ones substituted. As few bolts as possible ought to be used, and those of great strength. Miners, generally, are not mechanics; and where engineers are employed, it is seldom much time can be spared to keep the pump idle for repairs—and it becomes important to have the pumps and machinery to work them as little complicated as possible.

For miners, the pumps I make are so arranged that the valves can be got at without disturbing the pump or pipes—the opening to get at the valves being covered with a cap, (see page 33, marked E E,) and secured by two bolts; these being removed, the old valves may be taken away, and new ones inserted, in a few minutes.

The pumps being double action, they raise water at the up and down stroke alike. One cylinder pipe and pitman answers all the purposes of the complicated machinery that is often imposed upon merchants supplying mines—in some case three single action cylinders or pumps, three pitmans, three throw cranks—all this mass of machinery for the purpose of raising water.

Several pumps are in operation that I have furnished for iron, copper, and other mines. One in a copper mine in Cuba raising 400 gallons per minute 150 feet high, worked by steam. Several in New-Jersey, worked by horse power; several in Mexico worked by mules.

RAILROADS

In railroad water stations, I have supplied pumps in almost every variety of situation. The Reading railroad has a four inch pump at Richmond worked by steam; at Norristown water station, a six inch pump worked by a water wheel, taking the water from a spring and raising it to a reservoir 400 feet distant. A five inch at Port Kennedy station, worked by a water wheel through 350 feet of pipe, 40 feet rise, to the reservoir, and gives 32,000 gallons per day; a four inch pump at Pottstown station, worked by a horse; a six inch pump at Schuylkill Haven, forcing water 2,200 feet, 40 feet rise, worked by a water wheel. Other railroads are supplied with them, and several working in wells, raising water in some cases over 90 feet.

Below I extract a statement made by the chief engineer of the Reading Railroad Company. I will also add, that the Utica and Syracuse railroad have the whole line of road fitted up with pumps of the same kind:—

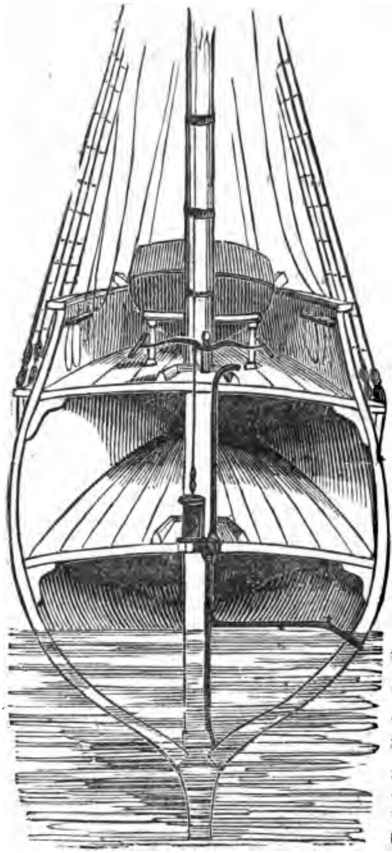
Mr. S. Meredith:

Farnam's double-action lift and force pumps have been in use daily on the Philadelphia and Reading railroad, for the last nine months, in five different places, during which time they have given general satisfaction—have done their work well, and have not cost as yet one dollar for repairs. The company intend putting up more of them as soon as occasion may require.

JAS. H. OSBORN,
Chief Engineer P. and R. R. Co.

Pottstown, Nov. 18, 1845.

SHIP PUMPS.

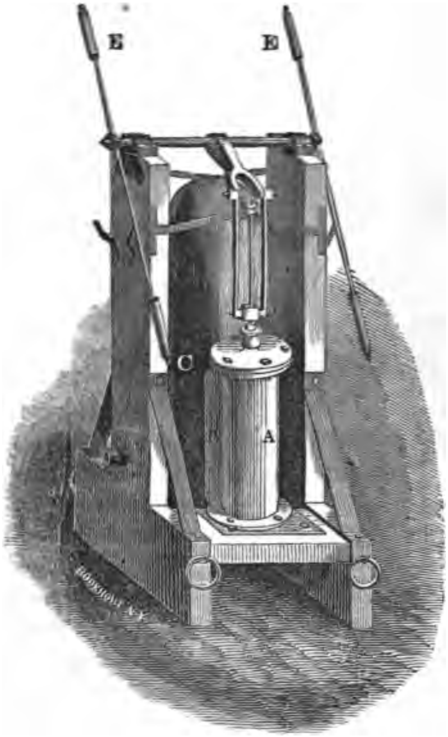


The annexed cut represents a vertical section of a ship, with a double acting pump placed on the berth deck, the section pipe running down into the run, with a branch passing out through the side of the vessel for the purpose of drawing water from over board, each pipe having a stop-cock inserted in it, the discharge pipe passing up through the deck with a gooseneck and male screw for the purpose of attaching hose to, (when the gooseneck is not required it can be removed flush with the deck.) It is worked on the upper deck by a double brake for four or six men, or a single brake, as occasion may require. By attaching hose to the gooseneck, water may be conveyed to any part of the vessel, for washing decks, filling water closets, cleansing the hold, wetting sails, or in case of fire. For all the above purposes, the stop-cock is opened in the pipe leading overboard, and the one in the pipe leading to the run is closed, thereby drawing water from overboard.

The cut on the next page represents a moveable ship engine, so arranged by rings at each end that two persons can carry them. This form, in some cases, is better than a stationary one, as the head and stern pump pipes can be so fixed that the engine can be connected with either; or by having a pipe leading down through the kilson, can be used mid-ships, answering all the purposes of washing decks, wetting sails, etc., also for drawing water from the water tanks. For that purpose a small suction of one and a quarter inches diameter on the inside is used, sufficiently large to enter the bung of a cask. This suction can be either of gutta percha or leather, flexible.

Gutta percha needs to be used with extreme care, and covered with canvas, if exposed to heat of any kind, as heat will destroy it by melting.

They are a complete fire engine, and can be worked by two or eight men, as occasion may require. Many of the East India ships have them for the express purpose of wetting sails, as the hose can be taken aloft, and there used with equal effect. It may be used for pumping out the ship in case of an emergency, (as two single acting lift pumps, made of copper, are mostly used for the main pumps,) by having a pipe leading to the run, with a coupling attached to match the engine suction.



I manufacture three different sizes, viz., four inch, three inch, and two and a half inch.

Four inch brass pump, double acting, with 23 feet suction hose, 30 feet leading hose, branch pipe, nozzle, couplings, all complete, brake to ship and unship, $200.

Three inch brass pump, to ship and unship, complete, $175.

Two and a half inch brass pump, to ship and unship, complete, $88.

STEAMBOATS AND STEAMSHIPS.

Very few remarks will suffice in relation to steamboats and ships, having given the form of putting them up under the remarks on ship pumps. They will answer all the purposes before mentioned—washing decks, etc., and for supplying the boiler, as well as cleansing the same from sediment. They can be arranged forward or aft, away from the boiler and engine, (which in case of fire is necessary.) The pumps can be placed below, and worked by a single or double brake, as occasion may require.

Pumps for the purpose of protection against fire, especially upon steamboats and ships, ought to be placed away from the engine and boilers, (the most likely place for fire to happen,) and the interference of passengers.

WATER BOATS.

I have supplied several water boats with pumps for forcing water on board ships, etc., and they have been found much superior to the single action heretofore used.

In connection with steamboat pumps, (as it may be useful to some readers,) it may be remarked, that in September, 1845, we fitted up for Daniel Barnum, Esquire, of this city, a five inch double-acting pump for the purpose of supplying a steam boiler, to be used on his plan of self-acting safety apparatus. The success of his plan is fully shown by the annexed certificate, from which steamboat owners may understand the use of the invention :—

CERTIFICATE.

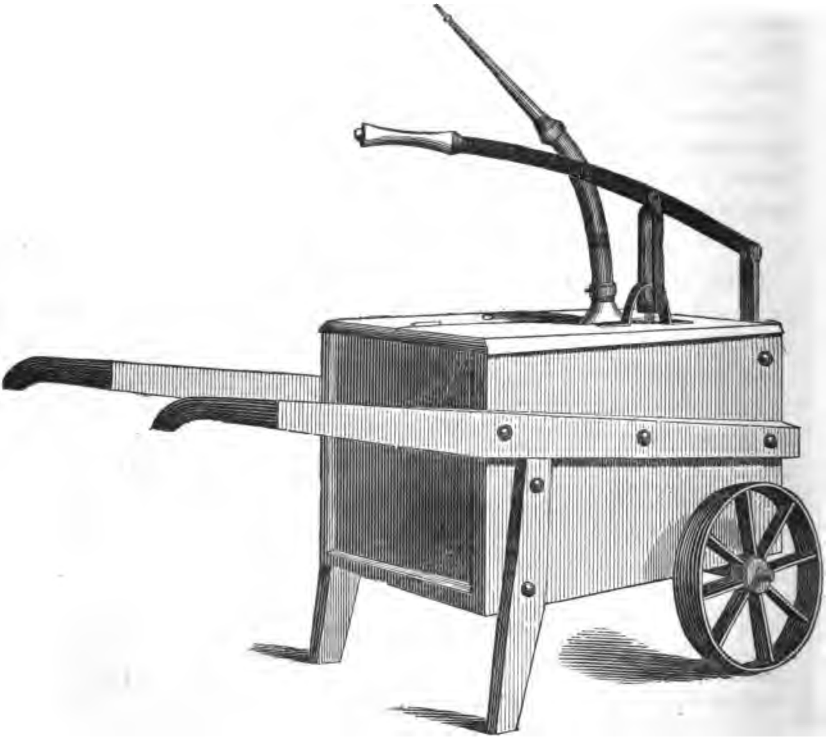
We, the undersigned, having witnessed the operation of Mr. Barnum's self-acting safety apparatus on board the United States steamer "Water Witch," while she was under public trial, do certify, that the apparatus, by its own action, supplied the boiler with great regularity, requiring no assistance from the engine; that its motion formed a most perfect index of the state of the water, (notwithstanding the boiler was said to foam continually during the trial,) stopping and starting at its own volition ; its revolutions being in proportion to the amount of evaporation going on. In short, the whole operation was demonstrative of the entire success of the apparatus in affording a uniform supply of water to the boiler, so far as we are able to judge from the exhibition made on this trial.

We also say that the apparatus was applied as a fire engine, as well as a bilge pump for pumping ship, for both of which objects it possesses great power and efficiency. And we take pleasure, while bearing this testimony to the merits of Mr. Barnum's improvement, in expressing the opinion that he has done much to *prevent* or to *mitigate* the evils which necessarily result from *steamboiler explosions, fires at sea, and a sinking ship.*

CHAS. GANNETT, Commander,
J. E. BISPHAM, Lieut.
G. W. CHAPMAN, Lieut.
JOHN FARON, Jr., Chief Engineer U.S.N.
R. F. LOPER.
B. F. McMURTRIE,

Philadelphia, Oct. 9, 1845.

GARDEN ENGINES.



The box of this engine will hold 40 gallons with a two and a half inch double acting lift and force pump. It is arranged with two cast iron wheels and handles, so that one person can wheel it from place to place. It has a branch pipe and rose jet, (for sprinkling plants,) and a short hose, that one person may work the engine and guide the stream; at the same time they are made strong in every part, and one person will throw water 60 feet horizontal and 40 feet high. They are well calculated for watering gardens, washing windows, destroying worms from trees or shrubbery, protecting houses against fire, etc.

The engine would prove very useful to horticulturists, and may be made servicable, in drought, for watering gardens, nurseries, etc. Price, complete, $45.

They can be arranged to take suction and draw the water from springs or cisterns. If not used in that way, the box may be filled with water.

STATIONARY FIRE ENGINES.

Stationary fire engines for villages are, in many situations, superior to moveable engines. The pump may be placed in a well, and the pipe laid along the ground, (below the reach of frost,) and have one or two openings, with screws on the end to fit the couplings on the hose used for fire purposes. To the pitman attach a brake with poles to be worked by any number of men required; the brake to unship and be kept in a convenient situation, so as to be ready for working while the hose is being attached. An engine of this description may be set at work more readily than a moveable engine, and within reach of the hose, will prove more efficient than other kinds.

The pump may be used as an ordinary street pump by having a brake fitted for that purpose, which may be detached when required. It can be so arranged as to work the pump by horse power, having the power under ground, except the post to attach the horse lever to. The public authorities offering a premium to those first supplying horses to work the pumps, in case of fire, would insure the pumps in operation as soon as the engines could be ready to receive the water; and when the fire is near, they may play directly on it from as many streams as there are openings in the pipe. The expense of engines on the above plan being much less than moveable ones, they are preferable where buildings are close together, and near a full supply of water.

In many factory villages and other places having mills or water power of any kind near, with a large pump so placed as readily to be put in operation by a water wheel, with plenty of hose, it will constitute a fire-engine of the most powerful and efficient kind.

I have supplied pumps, hose, pipes, etc., for several United States arsenels and navy yards, to be used as ordinary pumps and fire-engines; and in several instances they have been the means of saving a large amount of property.

STEAM ENGINES.

In some cases a steam engine would prove profitable for raising water for premises where a large quantity is required. If on a farm or plantation, the engine may be used for various other purposes beside raising water, such as grinding corn, coarse fodder, corn-stalks, hay or straw, churning, grinding apples, steaming food for cattle, turning grindstones or lathes, boaring fence posts and holes, sharpening rails, sawing wood, etc.

I have furnished pumps for supplying boilers, giving perfect satisfaction.

Prices of Steam Engines.—There are numerous engine builders in this city who do work equal to any in the country, viz.: Messrs. Stillman, Allen & Co., "Novelty Works;" C. Morgan, "Morgan Iron Works;" James P. Allair & Co., "Allari Works;" Hogg & Delmaster, and Samuel Bryant & Co.

The prices given below are those of one of our best manufacturers, whose business is exclusively confined to steam engines, Samuel Bryant, No. 97 Columbia-street, New-York. The prices include flues, boilers, with governor, pumps, cut-off, etc., complete, except masonry.

Horse Power.	Price.	Horse Power.	Price.
4	$500	30	$3,000
5	600	35	3,300
6	700	40	3,550
8	900	50	4,000
10	1,100	60	4,500
12	1,300	70	5,000
15	1,600	80	5,300
20	2,100	90	5,600
25	2,500	100	6,000

The advantages of raising water into a reservoir for supplying boilers is very considerable over the plan of drawing water direct from springs or wells, and supplying the boiler with cold water. When the supply is taken from the reservoir, the waste steam may be used to keep up heat in the reservoir, supplying the boilers with warm instead of cold water, making a great saving in fuel, and keeping up a better head of steam.

I have furnished many pumps for raising water into reservoirs. which have given full satisfaction. The power necessary to work them being, in most cases, so small that no sensible check was occasioned to the engine.

IRRIGATION OF LAND.

The value of water to irrigate land is not generally appreciated in this country. In most cases, the increased crops from the use of the surplus waters would pay a large per centage on the amount of outlay for water works. If farmers who have not water convenient, would keep an account of time expended in bringing water for family uses, particularly washing days, as well as driving their stock to water, they would generally find water works would prove a matter of economy as well as of convenience. Cattle, horses, hogs, and in fact *every* living creature, thrive materially better when having at all times a plentiful supply of pure water.

Many farmers have milk-houses at springs at considerable distance from their dwellings, when for a small outlay they could have the water from the same spring running through a milk-house at their door, and could do their weekly washing in their houses instead of at the spring. There is much improvement in the taste of farmers generally in this country respecting the style and convenience of their dwellings and out buildings, and the cultivation of their lands; and as plenty of good water is necessary to render premises *comfortable*, that object becomes one of the first importance to those not favored with that luxury. When persons are disposed to beautify their premises, having plenty of water at sufficient height, they may make many uses of it to promote health and enjoyment—such as baths for immersion and shower beathing, fountains, cascades, running water with gold fish sporting, and others with pickerel, which may be fed for the table as well as pigs.

This and much more is easily accomplished; and in fact every part of a country residence or farm ground may be made to teem with beauty, if a person has the taste and will improve upon nature. As this subject does not belong to this work, (save indirectly,) I have taken the liberty to hint, and hope that is sufficient for the wise.

CITIES, TOWNS, AND VILLAGES.

Cities, towns, and villages may, with few exceptions, have a full supply of soft, wholesome water for every family. The expense, when divided among many, is light; and as pure water is conducive to health, all are interested in having it in plentiful supply. It is seldom that cities or towns will vote to tax themselves to raise the necessary funds to build water works, but they are generally willing to grant the customary privileges to one or more individuals who will undertake the business. And as far as my knowledge extends, such individuals or companies have made the undertaking profitable, at the same time the citizens are benefited by having plenty of good water at a cheap rate. Some towns or villages may be supplied with water from springs or streams from sufficient elevation to discharge water at any required height; but when that is not the case, and water power cannot be had rightly located to answer the purpose, the next best power is steam. And as an engine requires an engineer, and fuel, the engine might be made to pay expenses by renting out power to propel machinery, reserving sufficient to raise the requisite quantity of water. When no high ground is conveniently situated for a reservoir, they may be placed on the top of the building that contains the engine and pumps, as has been often done, viz., at Burlington, and Camden, in New-Jersey.

When corporations or trustees of cities or towns grant the privilege individuals or companies to supply water to the inhabitants, they usually claim as a consideration a full supply for extinguishing fires. The prices charged by companies vary in different places, but the charge for a private family, I think, in no instance goes higher than $10. In some places the charges are, for the use of water for dwellings renting for $60 and under, $4 a year; from $60 to $150 per year, $5; over $150, $6 a year; extra, for pavement-washer, $3; bath, $5; garden and hydrant, $3; public houses, factories, etc., according to quantity used. In other cases, the prices are fixed, for one story wellings, $4; two stories, $5 three stories, $6; public houses, etc., from $10 to $50 per year.

In one case within my knowledge where a few individuals had a grant from the citizens of a town of about 4000 inhabitants to supply water, the subscription obtained in one day at the regular charges, amounted to five per cent. on the whole outlay—twenty-five thousand dollars.

The income from renting the power of the engine, with rent of building, would pay all the expenses incident to the business. and leave a surplus. In all probability, the stock would pay, in two or three years 10 to 15 per cent., and continue to increase with the population. I think water works, judiciously located, will prove the best permanent investment to be found.

Another *important* consideration is having a plentiful supply of water in case of fire. This is not *generally* appreciated until property has been destroyed, sufficient, in some cases, to build a dozen water works. It is quite a matter of economy to supply a place with plenty of water to extinguish fires *before* a great fire, in preference to doing so *afterwards.*

To enable persons to estimate the cost of water works, the present prices of cast iron pipes are given in small quantities :—

1	inch	cast iron	pipe,	16	cents per	foot.
1¼	"	"	"	18	"	"
1½	"	"	"	22	"	"
2	"	"	"	30	"	"
2½	"	"	"	33	"	"
3	"	'	"	38	"	"
4	"	"	"	60	"	"
6	"	"	"	80	"	"
8	"	"	"	1.25	"	"
10	"	"	"	1.50	"	"
12	"	"	"	1.75	"	"

Elbows, branches, angles, etc., three and a half cents per lb. for three inches and over.

I would observe, that lead pipe is generally preferable for any size under three inch.

I also insert a table of prices of wrought iron pipes, which may be servicable to many for conducting water through buildings, or for steam or gas.

WROUGHT IRON PIPE.

Internal Diameter of Pipe and Fittings.	*Inch.* 3	*Inch.* 2½	*Inch* 2	*Inch* 1½	*Inch* 1¼	*Inch* 1	*Inch* ¾	*Inch* ½	*Inch* ⅜	*Inch* ¼	*Inch* ⅛
Pipe, per foot, - - -	$1 25	$ 90	50	30	24	10	12	10½	9	8	7½
Elbows, each, - - - -	2 00	1 75	80	60	45	30	20	15	12	10	
Tees, each, - - - -		2 00	90	75	55	40	30	25	20	15	
Crosses, each, - - -		2 00	1 10	85	60		35	30	25	20	
Couplings, Caps, Plugs, Nipples, Reducing Sockets, Bushings, Locknuts, - -	1 00	80	40	25	20	15	12	10	9	8	7½
Return Bends, - - -			1 00	75	60	40	30	25	20	20	20
Iron Cocks, each, - -			5 00	3 00	2 25	1 50	1 00	80	65	55	
Brass Cocks, each, - -			6 00	4 50	3 50	2 75	1 75	1 25	1 00	75	
Brass Valves, - - -			8 50	5 50	4 25	3 00	2 00	1 50	1 25	1 00	40
Brass Soldering Nipples, -			75	50	40	30	25	20	17	16	
Flanges, complete, - -		80	45	35	30	35	20	17	15	14	14
Flanges, extra, - - -	1 50	1 00	60	50	45	40	35				
Check Valves, - - -			7 50	5 50	4 25	3 00	2 00	1 50	1 25		
Brass Union, - - -						1 25	1 00	75	50		
Iron Union, - - -		2 50	1 75	1 35	1 00	75	55	40	35	30	30
Brass Flange Tees, - -							40	35	35	25	
Brass Flange Elbows, -							40	35	35	18	
Brass Gauge Cocks, - -						3 00	2 00	1 00	75		
Bends, with Couplings, -			1 20	85	65	45	35	26	21	18	
Tongs for Pipe, - - -		2 75	2 25	1 75	1 30	1 10	90	75	65	65	65
Taps, - - - - -			3 00	2 50	2 00	1 75	1 50	1 25	1 00	90	
Dies, - - - - - -			1 75	1 60	1 50	1 30	1 20	1 10	85	75	
Screw Plates, - - -											
Wrought Iron Hooks, - -			4	3½	3	3	2	2	1½	1½	½
Mal. Straps, - - -			3	3	3	2	2	2	2	2	2
Wrenches, - - - -			64	50	40	30	25	20	17	15	15
Brass Safety Valves, -		12 00	9 00	5 50	4 25	3 25	3 00				

Respecting the quantities of wrought and cast iron pipes for the purpose of conducting water, I would not recommend wrought iron in preference to cast iron pipe, as the former will corrode much more rapidly than the latter. I have seen cast iron pipe after being 30 years in use under ground, as far as appearance went, as good as when new. I have seen, likewise, wrought iron pipe corroded in six months. The impurities of the water probably had much to do with the rapid decay of the latter. But with the *same* quality of water, cast iron is far preferable.

LEAD PIPE.

The following is a table of the weights and sizes of lead pipe, and is remarkable for its accuracy of calibre and uniformity of thickness—for the perfect polish of its interior surface, the absence of *scales* and *flaws*, for solidity and unusual strength, and the long lengths, by avoiding the expense of numerous jointings, offer decided advantages:—

WATER PIPES FOR HYDRANTS, PUMPS, ETC.

Calibre.		*Weight per yd.* lbs.	oz.	*Thickness. in* 100*ths of an inch.*	*Av'rge length.*
⅜ inch,	light,	2	4	9	80 feet.
"	medium,	3	3	13	70 "
"	strong,	4	6	18	55 "
½ inch,	ex. light,	2	8	9	60 "
"	light,	3	0	11	75 "
"	medium,	4	0	14	60 "
"	strong,	5	8	17	70 "
"	ex. strong,	6	6	20	55 "
⅝ inch,	ex. light,	4	0	11	70 "
"	light,	5	0	14	65 "
"	medium,	6	8	17	60 "
"	strong,	7	8	20	50 "
"	ex. strong,	9	0	22	45 "
¾ inch,	ex. light,	5	0	13	60 "
"	light,	6	4	15	47 "
"	medium,	8	0	19	43 "
"	strong,	9	12	22	35 "
"	ex. strong,	10	8	23	33 "
1 inch,	ex. light,	6	14	13	60 "
"	light,	8	5	15	45 "
"	medium,	10	5	18	35 "
"	strong,	12	4	21	30 "
"	ex. strong,	14	4	24	25 "
1¼ inch,	ex. light,	8	2	13	45 "
"	light,	9	12	15	38 "
"	medium,	11	0	17	32 "
"	strong,	14	10	21	25 "
"	ex. strong,	17	8	24	21 "
1½ inch	ex. light,	10	8	14	45 "
"	light,	13	0	17	30 "
"	medium,	15	8	20	25 "
"	strong,	19	0	23	20 "
"	ex. strong,	24	0	27	-- "

Calibre.		*Weight per yd.* lbs.	oz.	*in* 100*ths of an inch.*	*Av'rge lengths.*
1¾ inch,	ex. light,	11	0	12	30 feet.
"	light,	13	6	15	25 "
"	medium,	16	0	18	24 "
"	strong,	20	0	22	18 "
2 inch,	ex. light,	14	0	14	40 "
"	light,	16	12	16	24 "
"	medium,	20	8	20	16 "
"	strong,	23	0	23	14 "
"	ex. strong,	27	0	27	12 "
2½ in.	3-16 in. thick	23	8		29 "
"	1- 4 "	33	0		25 "
"	5-16 "	41	0		20 "
"	3- 8 "	50	0		16 "
3 in.	3-16 "	28	0		25 "
"	1- 4 "	38	0		20 "
"	5-16 "	48	0		18 "
"	3- 8 "	59	0		13 "
3½ in.	1- 4 "	45	0		18 "
"	5-16 "	55	0		14 "
"	3- 8 "	65	0		12 "
4 in.	1- 4 "	49	0		15 "
"	5-16 "	63	0		12 "
"	3- 8 "	76	0		10 "
4 in.	waste pipe,	15	18		
"	" "	25	0		
4½ in.	" "	17	4		
"	" "				
5 in.	" "	20	9		
"	" "				
5½ in.	" "				
"	" "				
6 in.	" "				
"	" "				

FOUNTAIN OR AQUEDUCT PIPE.

Very light leaden pipe, for conducting water from springs at long distances, under slight pressure or head of water, and for chemical and other uses.

No. 1.

Calibre.	*Length.*	*Weight per yard.*	*Thickness. in* 100*ths of an inch.*
⅜ inch,	60 yds.,	1 lb. 8 oz.	07
½ "	40 "	2 lbs.	08
⅝ "	30 "	2 lbs. 8 oz.	07
¾ "	25 "	3 lbs. 8 oz.	09
1 "	60 feet,	5 lbs. 14 oz.	11
1¼ "	60 "	7 lbs.	11

No. 2.

Calibre		*Length.*	*Price per rod.*
⅛ inch,	on reels,	40 to 60 rods.	
½ "	"	30 to 50 "	
⅝ "	"	25 to 35 "	
¾ "	"	20 to 30 "	
1 "	in coils, about 60 feet long.		

MINERAL WATER PIPE.

Lead Pipe.			*Composition.*		
⅛ inch.	¼ inch.	⅜ inch.	⅛ inch.	¼ inch,	⅜ inch.

SHEET LEAD.

Weight of square foot, 2½, 3, 3½, 4, 4½, 5, 6, 7, 8, 9, 10 lbs., and upwards.

I also insert the following table of gutta percha pipe, which is prefered by many; and for many purposes preferable to any other pipe :—

GUTTA PERCHA PIPE.

CROTON—*for great pressure and suction.*

$\frac{5}{8}$ inch,	. . .	12 cents per foot.
$\frac{3}{4}$ "	. . .	15 " "
1 "	. . .	20 " "
$1\frac{1}{4}$ "	. . .	25 " "
$1\frac{1}{2}$ "	. . .	35 " "
2 "	. . .	45 " "
$2\frac{1}{2}$ "	. . .	60 " "
3 "	. . .	75 " "

AQUEDUCT PIPE.

$\frac{3}{8}$ inch,	. . .	5 cents per foot.
$\frac{1}{2}$ "	. . .	6 " "
$\frac{5}{8}$ "	. . .	8 " "
$\frac{3}{4}$ "	. . .	10 " "

BEER PIPE.

$\frac{1}{4}$ inch,	. . .	10 cents per foot.

SODA PIPE.

$\frac{1}{4}$ inch,	. . .	10 cents per foot.

SPEAKING PIPE.

$\frac{5}{8}$ inch,	. .	8 cents per foot.

SIPHONS

May be advantageously used in some situations, to draw water from a higher to a lower level, when natural or artificial obstructions prevent the pipe being laid in a direct descent—rocks or rising grounds, etc. intervening between the water and the place where it is wanted. As water is raised in siphons by atmospheric pressure, the perpendicular height from the surface of the water to the highest point or apex should not be more than 25 feet. The operation of the siphon depends on the descending pipe being perpendicularly longer than the ascending. Horizontal distance in either makes no difference save in friction. When used to draw water from a source deficient in quantity, the pipe will so far discharge as to admit air, when the water will cease running.

My purpose in introducing this subject is to point out a method for obviating this objection. In the reservoir in which the receiving end of the pipe is inserted suspend a lever of wood or iron by its centre, on a level with the bottom of the pipe—with a valve to close the mouth of the pipe. On the opposite end of the lever attach a perpendicular rod of iron or wood with a block of wood to answer the purpose of a float, having a hole through it to slide up and down on the rod, with a wedge to retain it at any required point. Suppose the water is 12 inches above the mouth of the pipe, and the float is keyed on to tho shaft at that point, consequently, as the water rises above that point, the float will be raised with it, necessarily depressing the opposite end of the lever, thereby opening the mouth of the pipe and allowing the water to pass up. As soon as the water falls, the float sinks, and the valve closes the mouth of the pipe. By this self-regulating means, there is no danger of ever overdrawing the fountain, and stopping operation. It is also necessary that the delivery should be submerged under water.

Pipes for this purpose should be of the best quality, and perfectly tight. After being laid and ready for use, it is necessary to extract the air before the water will flow. This may be done by attaching a pump to the lower end, and filling the pipe with water. Sometimes a cock and funnel are attached to the highest point of the pipe; then, closing each end, water is poured in at the funnel until the pipe is filled. Many mines may be so situated that the water may be discharged in this way, saving great expense.

HYDRAULIC RAMS.

Water rams have been introduced into this country from Europe, where they were invented in 1796, by Montgolfier, a French paper-maker. In many situations they answer well. The quantity of water that may be raised by them is but about one-half that which can be raised by a water wheel and pumps by the same power. The first cost being something less than a wheel and pump, some may be disposed to give them the preference. Improvements have been attempted here, but without success—as the plain Montgolfier ram is far better than any of the so-called improvements.

The quantity of water raised by a ram, in proportion to that expended as a power, varies according to the distance and height to be overcome. The best working machine that I ever saw in operation raised seven pints per minute, 40 feet high, through 200 feet of pipe. The fall of water was five feet, through 60 feet of pipe. The power was about 14 gallons per minute, as near as I can judge without measurement. Rams can be made useful to raise only small quantities of water. They cost, independent of pipe, from $12 to $25.

The following simple rule of ascertaining the amount of water that a given fall will give at a given height, I insert for the convenience of those wishing rams. I have compared it with various other rules, and with the amount of water given at places where rams have been put up, and found it correct, viz.: see how many times higher the height the water has to be forced than the fall, add a cipher to the product, and divide it by seven, and you will have the quantity of water wasted to force up one gallon, independent of friction of pipe, etc.:—

Fall.	Height.	Quantity.
5 feet,	20 feet,	5 5-7 gallons.
5 "	30 "	8 4-7 "
5 "	40 '	11 3-7 "
5 "	50 "	14 2-7 "
5 "	60 "	17 1-7 "

GENERAL OBSERVATIONS.

The foregoing pages, stating the purposes for which the pumps I manufacture are used, and in some cases detailing the plans of operation, do not comprise all, nor in fact but a small part of the various situations and objects they have been supplied for. The circumstances are so various in the different situations that it would increase the bulk of this work too much to enter into particulars to meet the requirements of every one; but this much I will say, that any building or place, however situated, provided there be adequate source from which water can be had, can, from some of the modes named, have water conveyed to any part of their premises in quantities limited only by the supply. I have intended to give a sufficient variety in detail to enable persons desiring information to form an opinion from the different plans which would be best for them to adopt—likewise the prices of pumps, iron and lead pipes, etc., with such tables as might be useful in enabling readers to estimate somewhere near the cost of putting up water works. All fixtures for the supply of water or hydraulic apparatus of any kind, ought to be of the best and most permanent description.

A supply of pure water is not a temporary requirement, either for domestic use, for manufacturing purposes, suppressing fires, irrigation of land, etc., but the demands for it will continue as long as man exists; and considered only in the light of economy, to fall, perhaps, from generation to generation. The above cautionary remarks will be found important. In many instance, I have known a large outlay necessary yearly to keep in operation water works improperly put up, or deficient in material, such as laying pipe not deep enough to avoid the effects of frost in northern climates, or using pipe of insufficient strength to withstand the pressure, etc.

When required, I will with pleasure give any information in my power, or make such drawings as may render assistance to persons putting up pumps, pipes, etc., and can furnish all the materials pertaining to the same.

TABLE *showing the different sizes of Pumps and the quantity of water each is capable of raising at* 30 *double strokes or revolutions of the crank, and the price of each size, fitted up on iron frames, with guides, shackles, and air barrels, complete, to work by power.*

Diameter of pump chamber.	Length of stroke.	Quantity of water raised in 30 revolu's.	Price of pump.	Position of pump.
2½ inches.	6 inches.	7½ gallons.	$35	Perpendicular.
3 "	8 "	14½ "	50	"
4 "	8 "	26 "	60	"
5 "	8 "	41 "	75	"
5 "	8 "	41 "	75	Improved.
6 "	12 "	88 "	150	"
6 "	24 "	176 "	200	"
6 "	30 "	220 "	250	Horizontal.
6 "	36 "	264 "	275	Perpendicular.
6 "	60 "	440 "	350	"
7 "	8 "	80 "	125	"
11 "	9 "	222 "	225	"
11 "	24 "	592 "	325	"
12 "	24 "	704 "	350	Horizontal.

These prices are for iron pumps, which are best calculated for fresh water. When pumps are wanted for salt water, for acids, alkalis, etc., brass pumps are used, for which an additional price, equal to the differnce between iron and brass, is charged.

AREAS OF CIRCLES.

(*Useful for finding the contents of pump cylinders.*)

Diameter. Inches.	Area. Square in.	Diameter. Inches.	Area. Square in.	Diameter. Inches.	Area. Square in.
1	.785	5½	23.758	13	132.73
¼	1.227	¾	25.967	14	153.93
½	1.767	6	28.274	15	176.71
¾	2.405	¼	30.679	16	201.06
2	3.141	½	33.183	17	226.98
¼	3.976	¾	35.784	18	254.46
½	4.908	7	38.474	19	283.52
¾	5.939	¼	41.282	20	314.16
3	7.068	½	44.178	21	346.36
¼	8.295	¾	47.173	22	380.13
½	9.621	8	50.265	23	415.47
¾	11.044	¼	53.456	24	452.39
4	12.566	½	56.745	25	490.87
¼	14.186	¾	60.132	26	530.93
½	15.904	9	63.617	27	572.35
¾	17.720	10	78.540	28	615.75
5	19.635	11	95.033	29	660.52
¼	21.647	12	113.090	30	760.86

INSTRUCTIONS TO THOSE PUTTING UP PUMPS.

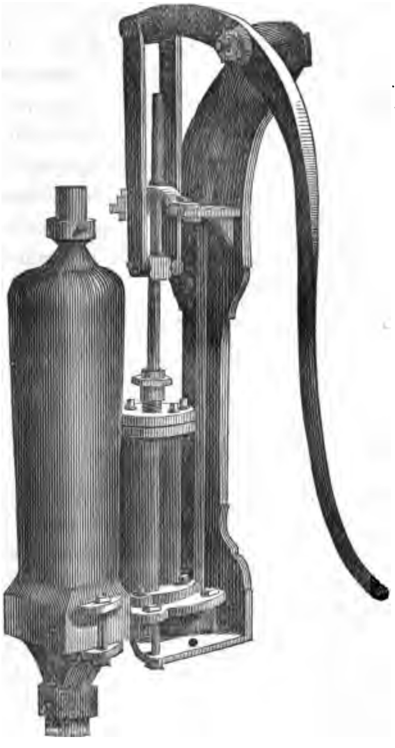
The first and important act is to try your pump, and see that it is in perfect order. Trust not to the manufacturer, but be sure you *know* that the valves work right. To try the pump, fill it full of water, and get the valves and pistons soaked, as they are always put in dry and stiff, and with one hand covering the opening, work it with the other.

For the two and a half inch pumps one and a quarter inch pipe is sufficiently small, and about medium thickness, (11 lbs. per yard.) The pipe ought to be carefully handled, and not laid with dents or bruises. Be careful of short turns, as all crooks in pipes cause friction, and the longer the turns the better. One way of taking out bruises is to procure a brass ball, nearly the size of the pipe, having a hole drilled through it for the purpose of passing a cord through. Having the ball tallowed, you will be enabled to draw it through, and remove them. In some cases, if the bruises are too bad, it is better to saw off the pipe and make a new joint.

When pipe passes down a well along the wall, have it well supported at short distances, as the motion of the water passing up through the pipe would cause it to settle if not well supported.

Respecting soldering the joints:—Let your solder be fine tin man's solder. By means of a ladle you can melt it, and run it into strips from 12 to 18 inches long. Your solder irons (as commonly called, although made of copper,) should be what is termed hatchet shape—the head about one or one and a quarter inch thick and two inches wide, the lower part drawn down to an edge, the longest way—the handle of iron, inserted in the thinnest side, near the top. This is the best shape for soldering joints, with cup joints.

To prepare the pipe for soldering, one end must be made bell muzzle by driving in a wooden plug one and a half inches diameter round, three inches long, and turned, tapering to three quarters of an inch. This will cup the pipe sufficient to receive the end of the pipe you wish to solder. Clean the pipe with a knife, and sprinkle a little powdered rosin in the cup, and you can easily make a strong joint, with a small quantity of solder.



When selecting a place in a dwelling for a pump, two circumstances must be taken into consideration : — first, security against frost; second, to get the pump as near (perpendicularly) the water as you can, bearing in mind not to place it more than 25 feet above the water, horizontal distance making little difference. The pump must be securely fastened in its place, and so situated that the valve boxes may be easily got at. When the pump is to be placed in the basement and the brake in the story above, by fastening the brake first in the position it is to be used, and with a line plumbing down, the true position of the pump may be ascertained. When the pump can be placed in the kitchen, and worked direct, I fit them as is represented in the annexed cut. The brake is attached to the frame, and connected to the piston rod by means of two shackle bars, which vibrate, preventing the rod (which passes through a guide) from wearing the stuffing box and bending the piston rod. The pump is bolted in the place required for it by three bolts on the back of the frame and two from the bottom. If the pipe is required to pass up into the stories above, it can be connected to the coupling on top of the air chamber; and for the kitchen purpose, a stop-cock can be inserted into the upright pipe, or in the air chamber, just above the flanch.

When the pump is placed in the house, and the pipes laid any considerable distance horizontal, it would be well to put a valve on the lower end of the suction. (See remarks on page 9.) And in laying your pipes horizontal, do not lay it *perfectly* so, but descending from the pump, some two feet in 100, and in as straight a line as possible. Be *sure* your work is well done before covering up the pipe. One other fact which may not be amiss respecting drawing water to the medium height perpendicular and any great distance horizontal, is an air chamber placed upon the suction pipe, and *as near the pump as possible,* some four or five times the capacity of the pump. This will be found beneficial in any case, but more particularly where the pump is worked by power or at a quick speed. In all pumps either double action or single, there is concussion upon closing the valves suddenly, which the air chamber overcomes; and the pump can be worked to a greater speed and with more ease, giving all the water that the power applied is capable of giving.

IRON PIPES.

The manner of conducting cast iron pipe is as follows: After the ditch is prepared, the pipe laid in, and one end inserted in the bell of the next length—each length to be laid on a brick, stone, or piece of wood, so as to raise it a few inches from the ground. When the pipe is properly placed, a packing of oakum or a slack twisted cord, cut the proper length to go around the small end of the pipe, is crowded into the opening between the cup and pipe at the joint; then have some blue clay, and after wetting it slightly, work it in the hand until it adheres well together, then form it into a roll one and a quarter inch diameter, and of sufficient length to go round the pipe at the connection, forming with the finger a cup on the upper side, into which melted lead is poured; then remove the clay, and with a cold chisel cut off the sprue or gate, and set the end up with a square end tool. This is the usual method of putting together cut iron water pipes, and is easily performed by any man of common ingenuity. A little practice will make an expert workman.

A beginner should try the pipe before covering it up; and if it leaks, the joints can be set over again. The pipe can be put together in pairs before laying it in the ditch, which will expedite the work.

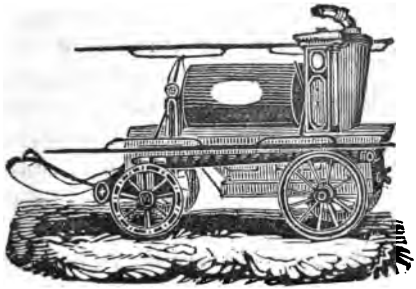
Any further instruction is deemed unnecessary, as the business is not intricate, and all that is required beyond what has been given will readily suggest itself to any person undertaking the matter. It may be well to say, that a job had better not be undertaken unless the person wanting it has it *well done*, hydraulic apparatus being among the worst kind of work to slight; and there is more labor to right a bad job than to do it well in the first place. Pumps should be put up with as much accuracy as a steam engine or any other machinery.

Wrought iron pipe is put together with screw couplings, and the joint is made by screwing them together with red lead, or India rubber, or leather washers, and by means of wrenches brought to a tight joint.

FIRE ENGINES.

Most of the fire engines in the United States are built with two single acting cylinders or pumps open at the top, with a valve at the bottom of each cylinder, and two valves under the air chamber, and worked by levers, either at the side or ends.

SIDE ENGINES.

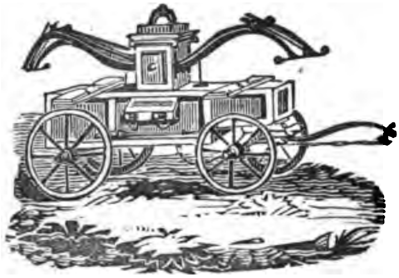


The following cut represents an engine working on the sides, the cylinders placed across the box or cystern, and the air vessel behind the cylinders. Side engines, from their peculiar construction, are obliged to have short levers, and require a quick stroke to be efficient. From the short distance the poles are from the centre, they work on a circle so small that the vibration from the perpendicular, necessarily gives the body of the person working the engine a motion in and out, which is a serious objection; which, with the necessity for rapid motion, will tire out men in a short time; and he is a good fireman who can stand it two minutes. Thomas Ewbank, in speaking of the above objections, in his work on Hydraulics, (page 337,) says, " this is sufficient to induce efforts to supercede the present mode of working pumps for fire engines, and particularly as the above labor is so severe that few can continue it above a minute or two at a time, when, if relays of men are not ready, buildings on fire are left to their fate. The concussion or jar produced by the violent contact with the side of the carriage at every stroke is a source of waste to firemen's energies, and a want of uniformity in their movements when at work is another."

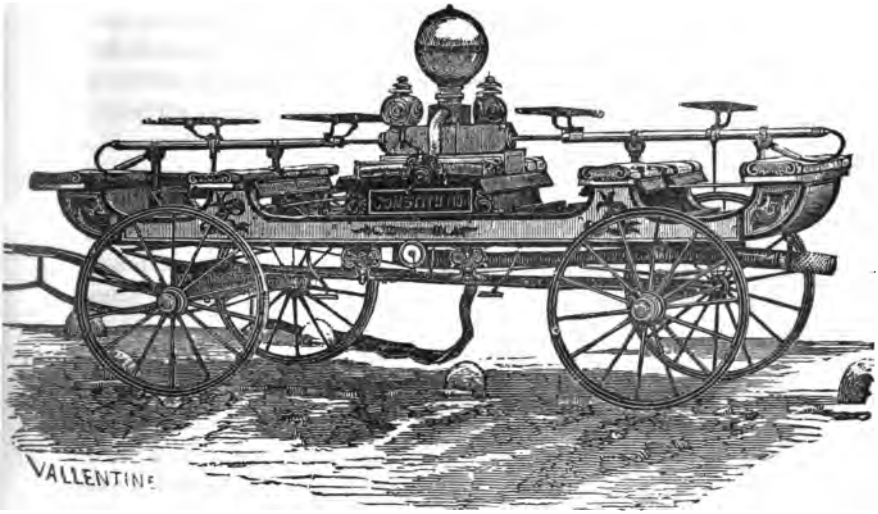
When a short lever engine is played, the water passing through open leaders, the motion is so quick, that if a person should take a stick in his hands weighing five or six pounds, and make the same number of motions in as quick time as made while working the engine, he will beceme tired out in a few minutes. The power applied to work the engine is dependent on the muscles of the arms; but the body has to be in violent motion, owing to the poles moving in so small a circle.

LONG LEVER ENGINES.

The next cut represents a fire engine working across the ends, the cylinders fore and aft, and the air chamber between them. Engines on this plan have direct connection of the piston to the cross bars of the brake, doing away with the chains and wheels, as on the side engines, and with them much machinery, useless weight and friction. The levers are long, and consequently have a more perpendicular motion. The cylinders are large, which renders it efficient with a slow motion, enabling firemen to apply the weight of their bodies to assist in working the engine; and one set of firemen will work an engine, on this plan, for hours without changing, which is one of the advantages which the latter has over the former.



In all cases where the two kinds of engines have been brought to work side by side at a fire, the advantage of the engine working across the ends over those across the sides is so evident that preference will always be given by those acquainted with both kinds to the long levers.



NEW PLAN OF WORKING FIRE ENGINES.

As one of the objects of this work is to bring before my readers the best plan of hydraulic apparatus, I would introduce a new plan of working fire engines as manufactured by D. L. Farnam, at Cincinnati, Ohio. The following is taken from his work:—

"The only opening for any considerable improvement in fire engines over the best plans heretofore in use, I have long been satisfied must consist in the plan of working them; for it must be evident to any person acquainted with the subject, that firemen cannot use their strength to the fullest advantage when working on the brakes as usually practised. Mr. Ewbank, in his work on Hydraulics, says that when a man's strength is applied, as in the act of rowing, the effect is nearly one hundred and fifty per cent more than in moving a pump lever. This is sufficient to induce efforts to supercede the present mode of working pumps of fire engines.

It will be perceived by the cut that the firemen sit with one or both feet braced up nearly level with the seat. I have found by experiment that a man of no more than ordinary strength can in this position raise a weight one hundred and fifty pounds thirty inches, and keep it passing up and down that distance as many times a minute as the usual number of strokes per minute upon the ordinary styles of engines. It is known that firemen working on the side engines do not apply over 30 pounds on an average; and on engines with long levers working across the ends, about 50 pounds.

In addition, it must be understood, that firemen working, as in the act of rowing, can continue to work (applying a power of 150 lbs.) much longer than those working on the ordinary engines, while applying only 30 to 50 lbs. and the labor will not be so fatiguing.

The following are the different sizes and prices as manufactured by D. L. Farnam, at Cincinnati, Ohio, with a few certificates of trials, etc. :—

For 16 men,	from	$ 900 to $1000	For 18 men,	from	$1000 to $1200
" 20	"	1000 to 1200	" 24	"	1200 to 1500
" 32	"	1500 to 1800	" 44	"	1800 to 2500

The first engine built in Cincinnati, for the Independent Fire Company No. 3, was tried by being taken to the river at the levee, 17 lengths of hose (850 feet) attached leading up to Front-street, along Front about 200 feet; the perpendicular rise from the water's edge to Front-street 60 feet. The engine was worked by 20 men inexperienced in working an engine on this plan. The pump was filled and water discharged from the nozle in one and a half minutes, and played (three quarter inch nozle) 110 feet from the nozle to where the greatest body of water fell. Time of playing, seven minutes. The same engine with 20 men, played through 100 feet of hose, horizontally, 150 feet, measuring as before. Four men, through 50 feet of hose, played (three quarter inch nozle) 73 feet. Again, 20 men played (one inch nozle) 100 feet; 20 men, 650 feet hose, leading up an elevation of 30 feet from Third-street to Fourth, (three quarter inch nozle,) played 133 feet.

In all of the above trials the streams were kept up during the whole time of working the engine. Measurement in all cases from the end of the nozle to where the main body of the water fell—no thumbing.

The second engine, built for the Washington Fire Company, No. 1, of the same size pump as the first name, but seated for 24 men, played, with 50 feet hose, (three quarter inch nozle,) 173 feet.

The third, built for the Marion Fire Company, No. 8, 4th class, for 16 men, played (one-half inch nozle) 150 feet. Also supplied a brake engine with 26 men, the horizontal engine being worked by only 13 men.

	MEN.
4th, Missouri—St. Louis, Mo.	24
5th, Amison—Ripley, Ohio	24
6th, Ohio—Mansfield, Ohio	24
7th, Texas—Cincinnati	18
8th, Simon Kenton—Covington, Ky.	24
9th, Tom Thomb, brake engine	24
10th, Ocean—Connersville, Ind.	24
11th, Scioto—Memphis, Tenn.	20
12th, Washington—Vicksburg, Miss.	24
13th, Tempest—Cincinnati,	20
14th, Washington—New-Orleans	20
15th, Gen. Washington—Cincinnati,	32
16th, Henry Clay—Covington, Ky.	32
17th, Ohio, No. 2—Piqua, Ohio	18
18th, Hoosier—Richmond, Ind.	18
19th, Ohio—Cincinnati	44
20th, Good Will—Franklin, Ohio	18
21st, Vigilant—Maysville, Ky.	18
22d, Neptune—Hamilton, Ohio	33
23rd, Friendship—Indianapolis, Ind.	32
24th, Scioto—Circleville, Ohio	24
25th, Eagle—Cincinnati	20
26th, Missouri—St. Louis, Mo.	44
27th, Shawnee—Xenia, Ohio	20
28th, Reindeer—Cincinnati	20
29th, Union—U.S. Arsenal, St. Louis	32
30th, Ocean—Milwaukie	32
31st, ——— Newark, Ohio	24
32d, Fame—Columbus, Ohio	32
33rd, Jenny Lind	20
34th, Fame—Memphis, Tenn.	32

Respecting the distance thrown by different engines, I would say, that I have many certificates that give statements of throwing great distances. They are given of throws made under favorable circumstances, and I decline publishing them, for the reason that those first using my engines, generally expect to equal the best throw they ever heard of being made. This much I would say, that any one who understands the advantages firemen have in the position, when working on the horizontal engine, will be satisfied that the engines can't be beat by any worked on the old plans.

I would name one instance of many where the advantages of the horizontal plan of working engines was very evident, viz.: a 24-men engine, having 800 feet of hose leading up a ladder on to a three-story house, was worked over an hour without the firemen ceasing their stroke or changing men. At the same time, a brake engine worked only 200 feet of hose, was kept at work during the same time by constantly changing their men, and some 200 different firemen worked on the engine during the time. This fact plainly shows the advantages of the horizontal fire engine over all others for suppressing fires.

The above named engines have been built since September, 1847, and have been in constant service since their completion. Those in Cincinnati and Covington—being ten in number—have had as hard service probably during the time as any engines in the United States. The horizontal fire engines have many advantages over the various kinds heretofore in use. They are of much less weight; wheels large, run more easily, body on springs. The works are all readily got at for repairs or to remove gravel. Firemen can work on them much longer, and throw more water, and ferther, with the same force.

Those who have observed the difference in the power of a person when seated, with his feet placed against a support nearly level with his seat, in raising a weight or pulling against a resistance, or doing the same while standing, will readily understand the advantages the horizontal plan of working engines has over the perpendicular or brake engines. Those wishing information of the favor in which they are held, are referred to any person named in this circular, or any other persons acquainted with them, or William Arnold, Hamilton, Ohio; Charles Ridgeway, Columbus, Ohio.

CERTIFICATES OF CINCINNATI FIREMEN.

Cincinnati, December 25, 1847.

The Washington Fire Company, No 1, purchased one of "*Farnam's Patent Fire Engines*," about the 15th of September last. The company is perfectly satisfied with it. It performs well in every situation where a fire engine can be used. We believe that its advantages over the old fashioned engines are enough to bring them into general use, as soon as they become known. We would not exchange ours for any engine we know of at the present time.

D. A. Baldridge,
John Vidal,
Wm. Starr,
W. Clary,
Jacob Starr,
R. G. Folger,
Fintin Horan,
Saml. Wolfington,
Charles Blair,
John Fox,
Chas. McDougal,
C. Robson,
Wm. Moore,
Charles Peers,
James Starr,
Charles Williamson,
Joseph Wrenshaw,
A. G. Banton,
Thos. H. Curd,
R. G. Bray,
Benj. Snowfield,
William Reading,
In behalf of the Company.

Cincinnati, December 27, 1847.

For the benefit of whom it may concern.—It is with pleasure the undersigned, members of Independence Fire Company, No. 3, give their opinions in favor of "Farnam's Patent Horizontal Fire Engines." This company has had one in use since the 18th September, and we find it answers fully the favorable expectations we had formed of this kind of fire engine. It possesses many and decided advantages over the old kind; and from our personal observation at fires we do cheerfully testify to its superiority over the old kind, in effectual service. It is quicker put in use, can be worked longer, and will throw a better stream, than any other engine we have ever used, with the same number of men.

A. H. Adams,
Henry Atkins,
Fredrerick Ohl,
A. Perry,
M. Y. Clark,
Morgan Fealty,
T. Arthurs,
S. W. Bloom,
N. Stewart,
W. Arthers,
In behalf of the Company.

At a trial had between the Pacific, a brake engine built on the Philadelphia plan, with extension levers, to man 60 men, and the George Washington, horizontal engine, built for 32 men, the result was as follows: [There was a strong side wind during the trial.]

CINCINNATI, March 7, 1849.

The undersigned judges of the trial of the two fire engines, George Washington, one of Farnam & Swift's Horizontal Engines, and the Pacific, No. 7's Brake Engine, make the following report:

The George Washington threw 191 feet, 1½ inches. The Paciffc threw 174 feet, 2½ inches. The stream was measured from the end of the pipe to the farthest drop.

S. W. BLOOM,
J. G. MILLER,
L. BYINGTON,

We, the subscribers, have been conversant with the horizontal fire engines, built by D. L. Farnam, and in use in this city. We have worked on them, and are well satisfied of their superiority over the old fashioned engines. They are lighter, run more easily, firemen can work on them with less fatigue. They are less liable to derangement, and with the same number of men, can throw water further, and keep up a stream longer, than any end or side brake engine.

CHAS. BLAIR,	President	Washington	Fire Company,	
JOHN E. PRICE,	do	Eagle	do	
J. P. EVANS,	Ex-do	Marion	do	
IRA STOUT,	do	Union	do	
W. B. SHELDON,	do	Franklin,	do	Covington, Ky.
DAN'L W. RIGGS,	do	do	do	do
G. E. MINISTER,	do	Hon'y member Franklin Fire Co.		
W. F. RUSSELL, WILLIAM ISHUT,		Union Fire Company.		
R. G. BRAY,				
A. G. BANTON,				
WM. MOORE,				
JAMES D. O'BRIEN,				
CLAY REEVES,				

MR. FARNAM: At a trial, had at Hamilton, with the horizontal fire engine, Neptune, Mr. Sargeant and myself measured the distance they threw water (seven eighth inch nozzle;) we measured with a tape line, and found the distance 207 feet. The "boys" are delighted with their machine. A. C BAGLEY,

Hamilton Hotel, Nov. 23, 1849. *Now at* 115, *Main-street, Cincinnati.*

CINCINNATI, June 29, 1850.

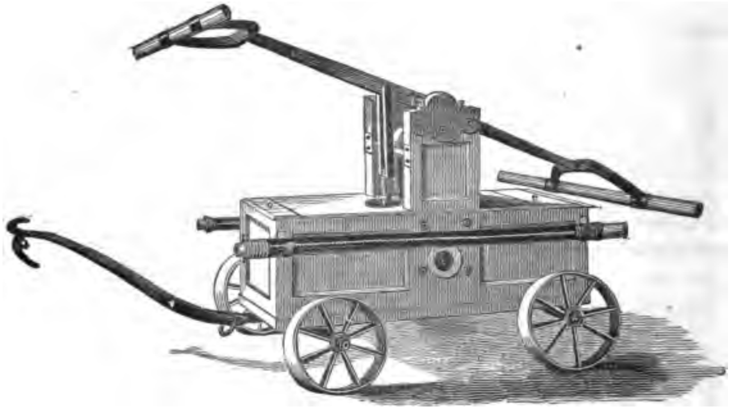
To MR. J. R. HASKELL, *Cleveland Ohio.*

Dear Sir: I have been shown this morning a communication from you, requesting my opinion of Farnam & Ransoms' Patent Horizontal Fire Engines. I would say, that I have been conversant with the above named machines for the past

three years, and do not hesitate in saying that I believe them to be far superior to any other engine which has yet come under my notice. We have now in use in Cincinnati, eight of these machines, (besides two in Covington Ky.,) all of which have given the highest satisfaction to the companies using them; and to any town or city wanting a fire apparatus, I would say, you cannot do better than to purchase the horizontal engine, as manufactured by D. L. Farnam, of this city.

R. G. BRAY, ***City Fire Engineer, Cincinnati.***

* * *



VILLAGE AND FACTORY FIRE ENGINES.

For those desiring fire engines for villages or factories, I introduce a cut of my own manufacture. They are light, easily handled, and worked by few men. I arrange them either with cast iron wheels and wrought iron running gear, or wooden wheels and running gear. The cut represents the engine with iron wheels, etc.

The pump is one cylinder, double acting, and placed in the centre, the brake running fore and aft, or across the ends. The suction hose is attached to the pump on one side, (when not in use, hung along the side of the box,) and the delivery hose from the opposite side. They are furnished in a plain but neat style. For prices and sizes, I refer you to price list, below:

G B. FARNAM 34 CLIFF-STREET, NEW-YORK.

LIST OF PRICES.

Garden engines, throw 20 gallons per minute, 2½ inch double acting lift and force pump, . . .	$45 00

Plantation fire engines, throw 66 gallons per minute, 4 inch brass double acting pumps,	$175 00
Plantation fire engines, throw 100 gallons per minute, five inch brass pump, double action,	225 00
The above plantation fire engines have iron wheels, are compact, easily handled, and complete in every respect, save suction hose, which can be added for	50 to 75 00

VILLAGE AND FACTORY FIRE ENGINES.

Four inch pump, to throw 66 gallons per minute, with eight men, iron running gear, 14 feet suction hose, 25 feet leading hose, branch pipe, nozel and ropes, complete,	240 00
Four inch brass pump, to throw 66 gallons per minute, eight men, wooden wheels and running gear, 14 feet suction, 25 feet leading hose, branch pipe, etc.	300 00
Five inch brass pump, to throw 120 gallons per minute, with 12 men, wooden wheels, etc. 14 feet suction hose, 25 feet leading hose, branch pipe and nozel, with ropes, complete,	380 00

In many cases two double acting cylinders can be placed in the same box by extending the bed, giving double the amount of water in the same time, by extending the amount of power or number of men.

LIFT AND FORCE PUMPS (DOUBLE ACTION.)

Two and a half inch house pump, iron, complete, save pipe, raise from 10 to 15 gallons per minute,	25 00
Two and a half inch house pump, same as above, with air barrel,	30 00
Two and a half inch house pump, same as above, with air barrel, cast iron frame, with or without brake being attached,	35 00
Two and a half inch house pump, air vessel, frame, and wrought iron brake attached,	37 50
Three inch pump, air chamber, raise from 14 to 30 gallons per minute,	42 50
Three inch pump, air chamber, and iron frame,	50 00
Three inch pump, air chamber, and iron frame, with wrought iron brake and fixtures separate,	60 00
Three inch pump, same as above, brake attached, two or four men,	60 00

Four inch pump, air chamber, raise 26 to 50 gallons per minute.		$50 00
Four inch pump, air chamber, and iron frame,		60 00
Four inch pump, air chamber, and iron frame, with wrought iron brake separate, for two or four men,		72 00
Four inch pump, with iron brake attached, two or four men,		72 00
Five inch pump, with air barrel, raise from 40 to 80 gallons per minute,		65 00
Five inch pump, with air barrel, and iron frame,		75 00
Addition, if made of brass: 2½ inch pump,	$ 7 00	
“ “ “ 3 “	15 00	
‘ “ “ 4 “	15 00	
“ “ “ 5 “	25 00	
Iron lift pumps, for cisterns, single rods, from		3 to 8 00
Wind mills, complete, with or without lower frames, from		75 to 500 00
Overshot and breast water wheels, to work pumps from three to nine feet diameter, iron shaft, crank, flanches, and boxes, (or iron work alone,) from		30 to 125 00

HOSE.

Superior Leather Leader Hose, made of best Wrought Copper Rivets.

1 inch diameter,	4 inch leather, per foot,	30
1¼ “ “	5 “ “	35
1½ “ “	6 “ “	50
1¾ “ “	7 “ “	56
2 “ “	7½ “ “	60
2¼ “ “	8 “ “	65
2½ “ “	9 “ “	70
2¾ “ “	10 “ “	75

Large Hose, Molasses, Locomotive sewed and suction Hose made to order.

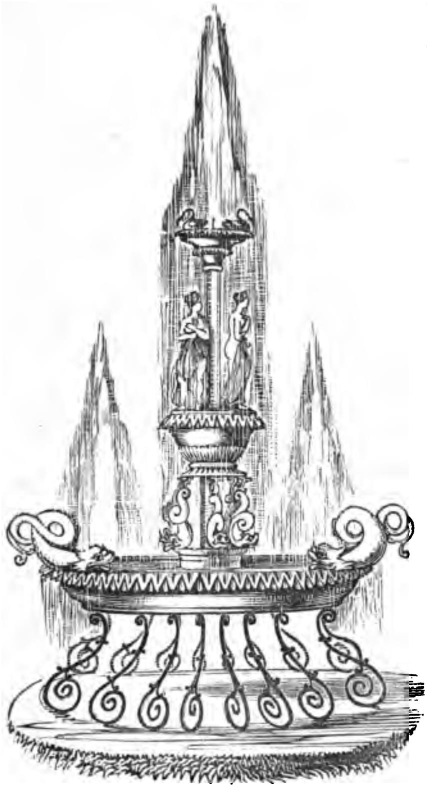
Suction hose, per foot from $2 50 to	$6 00
Molasses do “ from 50 cents to	1 00
Locomotive do “ same price as leading hose.	
Sewed, three seams, “ “ “	

Brass couplings of all sizes, either for hose or for pipe.

Branch pipes of all sizes, flanches, stop-cocks, side valves, etc.

FOUNTAINS.

In 1841, the author of this work commenced the manufacturing of cast iron ornamental fountains, and the cut below represents the first he finished. One of the same pattern was placed in the Horticultural Room at the Fair of the American Institute, and the Examining Committee awarded a gold medal. The following is an extract from their report:—



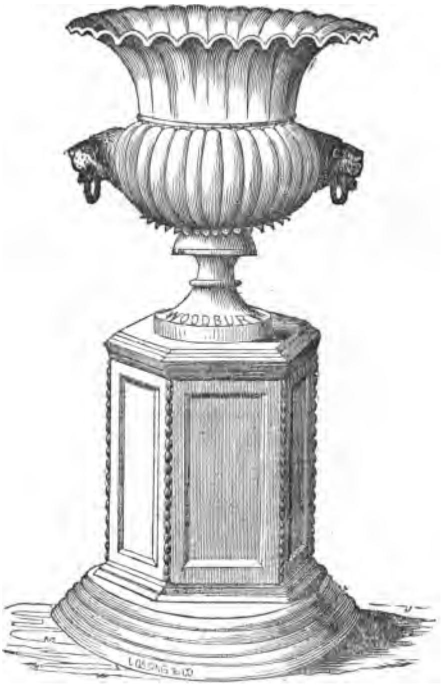
"This superb article might truly be said to form the climax of garden ornaments. It was got up by Mr. D. L. Farnam, of New-York, in a style that would do honor to any country, and displaying a taste and skill which richly entitle him to patronage. It consists of an extensive and lovely basin of clear water, in which gold fish are sporting over a bottom embedded with shells and aquatic plants, and surrounded by four Tritons sitting on the edge, and each throwiug up a jet of water like a burnished silver wire, to the height of six or seven feet, and meeting another jet from the centre, the whole falls into a little basin which forms the cap of a highly ornamented column of three or four feet high, from which it trickles over the edge, falling down on three female figures of great beauty, which surround the column, and thence returned to the fountain. A few tasteful gardens scattered about the country, each exhibiting such a fountain, would do much towards awakening a better taste in rural matters. Where there is a small stream of water near a garden level, the cost of such a fountain will be trifling; even where the water must be supplied by artificial power, there are abundant ways and means to facilitate the procuring a cheap supply. Yours, respectfully,

ALEXANDER WALSH,
LUTHER TUCKER,
W. EMERSON,
J. B. NOTT."

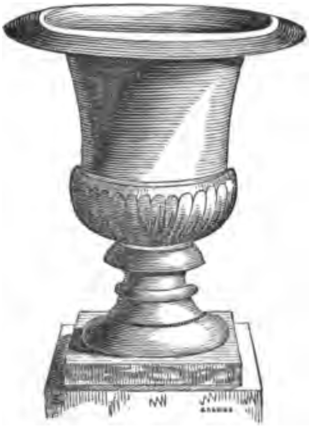
I have had several applications, by letter, for information on the subject of the best plan of making a *cheap* fountain, and will here describe one.

First; we will take it for granted that there is a head of water eight feet or over, that will supply 25 gallons or upwards per hour: select a location, say, the middle of the grass plot, or gravel walk in front of your house; then drive a stake for the centre, and with a rope and stick sweep a circle of the size you wish the basin—take out the ground from the centre outward, forming a basin sunk in the centre 10 or 12 inches. The earth taken from the basin I should remove, as I think a raised bank around a fountain does not improve it. By cutting a circle clear through the turf, you will have a handsome grass edge around the basin. The pipe from the reservoir may be half inch, and will cost about 87½ cents a rod. This pipe must be brought in a trench to the foundation, and rise perpendicular in the centre. To this end you want a brass rose jet, that will cost, say, one dollar. To carry off the superfluous water, you can insert a pipe at the height you want the water to stand in the basin, and lead the water off under ground, or let it run off on the surface, which will do no injury as to appearance or in fact, as it will be pure water. The next operation is to make the basin tight, which on the *very cheap* plan, may be done with clay, by puddling the bottom and sides, or by a coat of hydraulic cement, which will he but a small expense. In using cement, mix one third clear sand with it, and plaster the inside of the basin, having first rammed the ground hard. Next get, if you can, clean white pebbles, about the size of a walnut, to cover the inside of the basin; surround the pipe with handsome clean stones, piled in the shape of a cone, and you will have a fountain like that represented in the following cut with the exception of the vase.

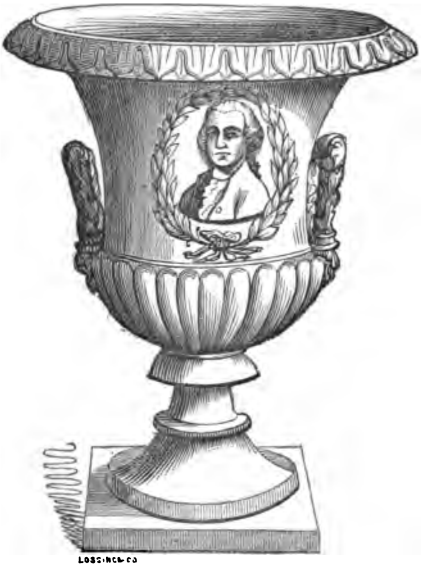
Running water, in the form of a jet or cascade, or in *motion* any way gives animation to the scenery, renders the air pleasanter in warm weather, gives life to vegetation in its vicinity, and pleasure to all within the sphere of its attraction. Those who have a supply of water must be wanting in energy, taste, or information, (the latter I mean to supply,) or they would have fountains, when the whole outlay, besides their own time will be for the lead pipe, as they may dispense with brass work, and contracting the lead pipe at the end, have a single stream rising perpendicular, which will spread at the top, and by some is admired more than the rose jet. There, reader, you have a plan of a *cheap* fountain, that can be made in a day; and as there is no objection on account of expense, if you have the water, go to work and improve your advantages. After you have found the increase of enjoyment to yourself, family, and visitors, perhaps in gratitude you will feel disposed to increase the pleasure of sight by sending to me for something to ***ornament*** your fountain.



No. 1.—This cut represents the Woodbury Vase, 39¼ inches high, and 21 inches across the top: price, $12. The lower portion is sectegon, supported upon a circular urn. The upper portion is circular, fluted, having two lions' heads on the side.



No. 2.—Plain Vase, 30 inches high, 25 inches across the pipe: price, $9 50 cents.

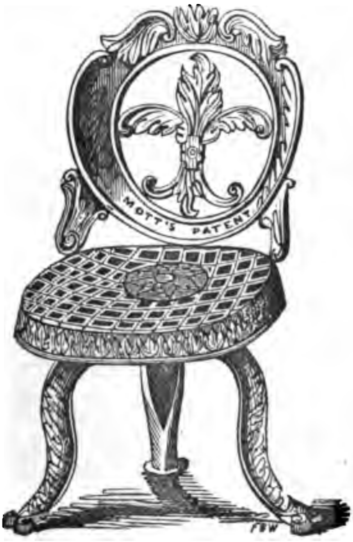


No. 3 represents the vases called the Washington and Franklin: height, 30 inches; 25 inches across the top. These two styles of vases are very neat and chaste, each style having the bust of their respective names, surrounded with a wreath upon two sides, and handles on the opposite ones. Price, $12.

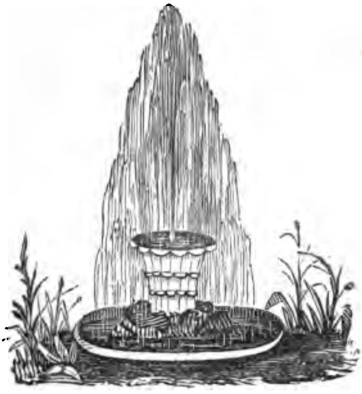
No. 4.—The Paloalto Vase. The style of finish is the same as the Washington and Franklin, having the edge ornamented, as is shown, but perfectly plain below the brim, and similar to the Plain Vase.

No. 1.—19¾ inches high,	16¼ inches across the top.	Price,	$4 00
No. 2.—24 " "	20 " "	"	7 00
No 3.—30 " "	25 " "	"	11 00

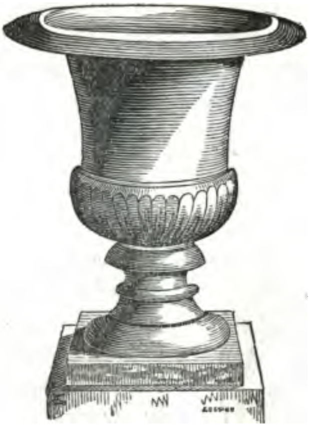
The foregoing description of various styles of cast iron vases intended for fountains, conservatories, public grounds, halls, etc., are equal to the finest Italian models, in durability, far superior, and can be made to represent freestone, granite, or marble. They are the invention of Jordon L. Mott, Esq., of this city.



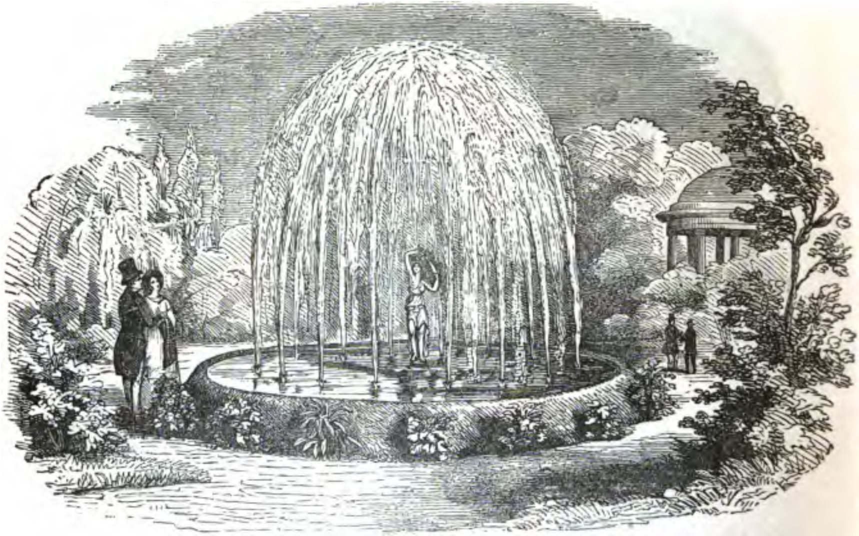
As connected with ornamental work for out doors, I insert the annexed cut of a cast iron chair, so made as to accommodate the anotomical form of the user, and perfectly easy to sit upon. They are also made for in doors. The one for gardens or out doors varies from the cut, having a hollow vase to fit over a post set in the ground.



No. 1, price $10.—A lily and cup, with brass rose jet, (or any other that may be preferred,) 16 inches high and 15 inches diameter at the top, of cast iron, composed of a circle of leaves and cap. This being placed on the top of the stones as stated in the description of cheap fountain, would enhance the beauty of it very much.

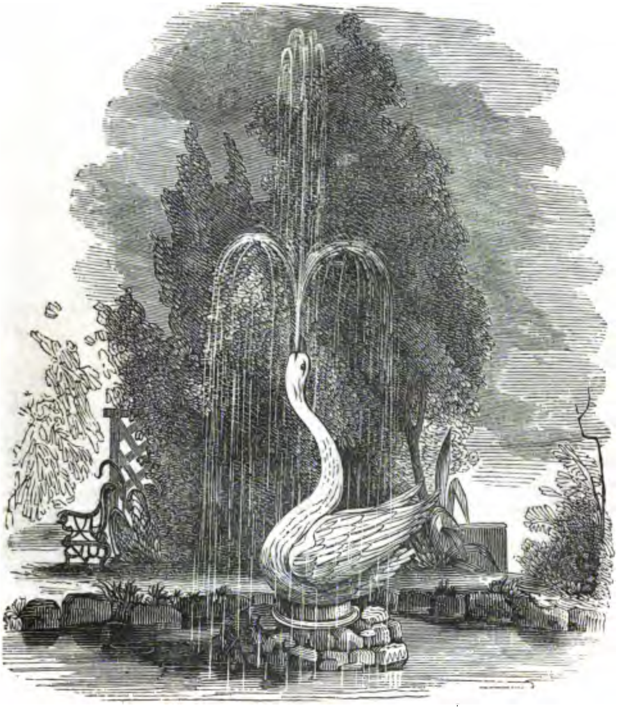


No. 2, $13.—Consists of the plain urn, including pipe, coupling, and three jets. Height, two and a half feet; 25 inches across the top.



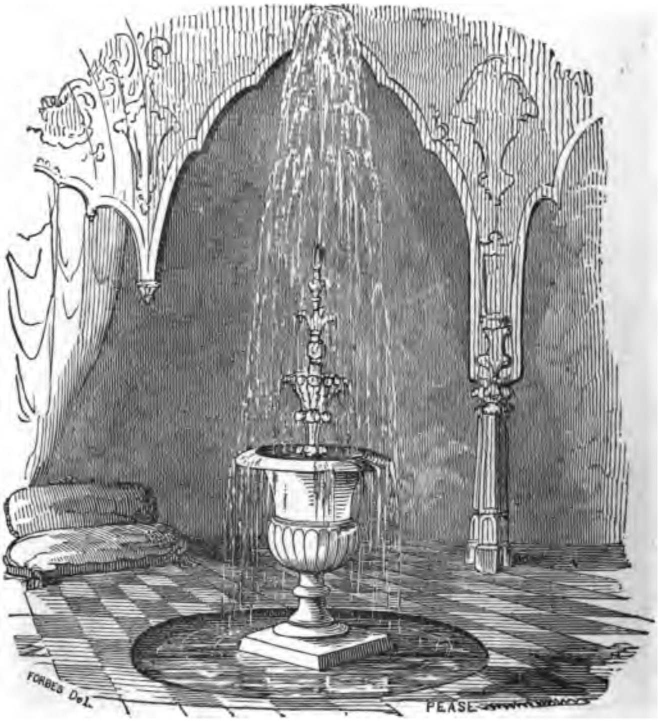
No. 3, $20.

No. 3.—Figure of Hebe. Height is three feet three inches. The jet comes from the top of the head, and is relieved by a rosette, having a screw upon it, for the purpose of making changes with the jets. The figure is surrounded by a number of fine streams of water so directed as to fall upon her, and covering her within a watery spray. These jets, twelve in number, are connected to a ring of pipe at the outer edge of the basin, and when required, are sent with the figure.



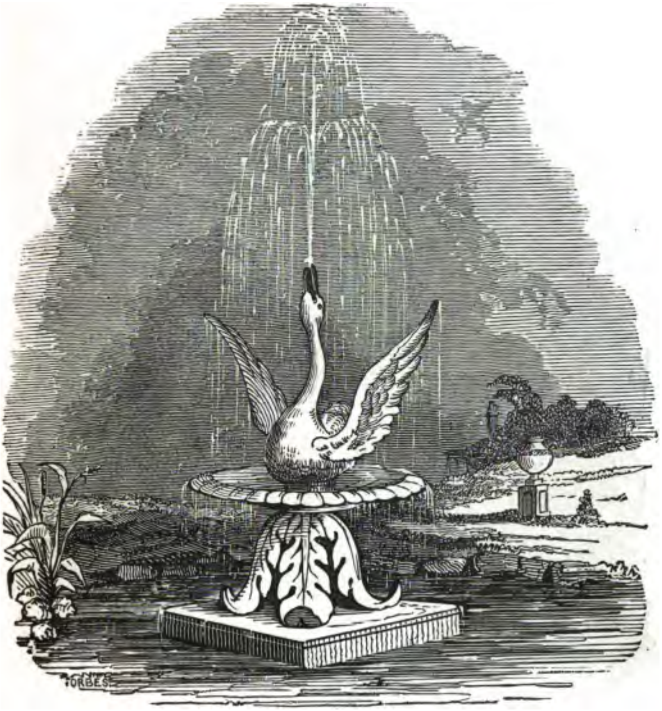
No. 4, $15.

No. 4.—A Swan. The height is three feet. The pipe passes through the body and neck, terminating in the mouth, with a screw for the purpose of changing the form of jet. It can either sit just flush with the surface of the water or raised upon a box and surrounded with rough stones, as represented.



No. 5, $35.

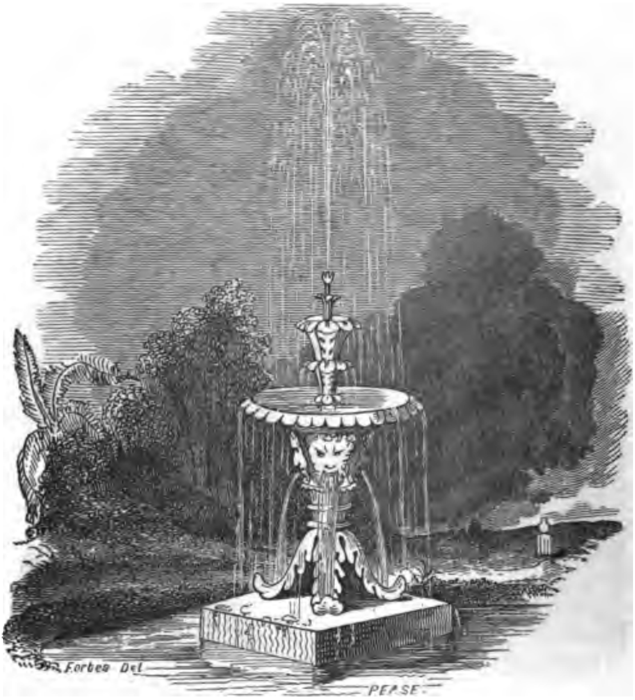
No. 5. Urn, lily, post, and other ornaments, making the whole about five feet high, the base 14 inches square, with the pipes, jets, etc. complete and ready to unite with the supply pipe. The water from the centre jet falls back on the ornaments, dripping from one to the other, into the urn, then running over the edge into the basin below. This forms a beautiful ornament. The urn may be placed on a rock or large stones in the centre of the basin. I have put them up in this way in a basin of 16 feet diameter, producing a beautiful effect.



No. 6, $40.

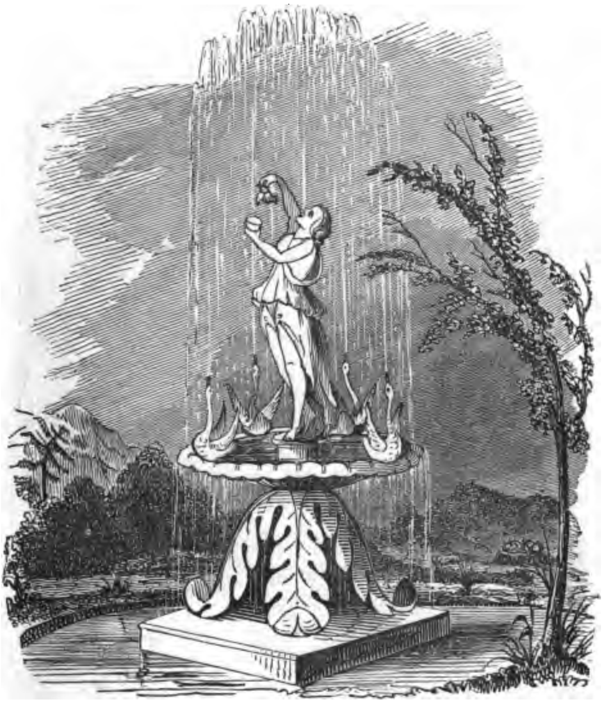
No. 6—Consisting of a square base, two feet diameter—eight leaves, supporting a pan 28 inches diameter, and swan three feet high.

The drawing or cut is a fair representation, except the leaves between the pan and base, which are represented as four only, and quite a space between; but there ought to have been eight leaves, rendering the fountain much superior in appearance. The same error exists in the engraving of No. 7.



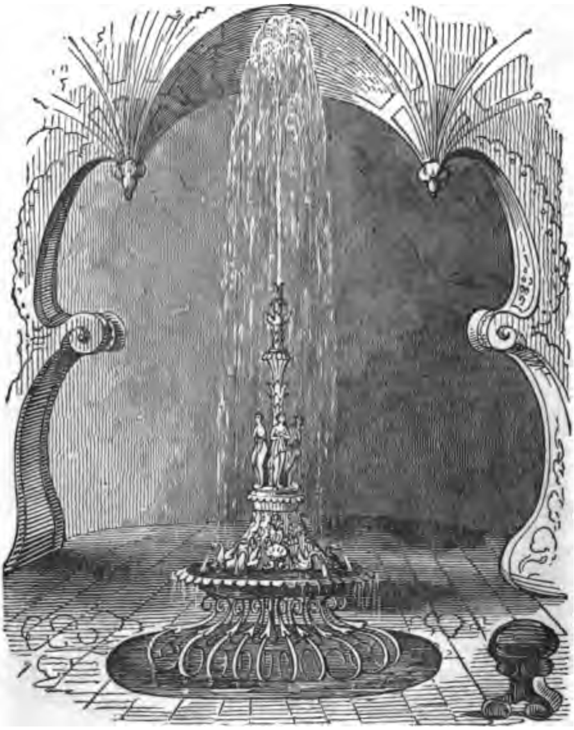
No. 7, $50.

No. 7.—This fountain stands about five feet high, consisting of a square base and eight leaves, same as No. 6; above the leaves is a crown supporting four masks of satyrs, on which is the basin, 22 inches diameter and a large lily surmounted by a small one, from which the centre stream projects. Streams flow from the mouths of the satyrs, which, together with the flow over the edge of the basin, and the centre stream, make a very pretty display. It is neat, chaste, and lively.



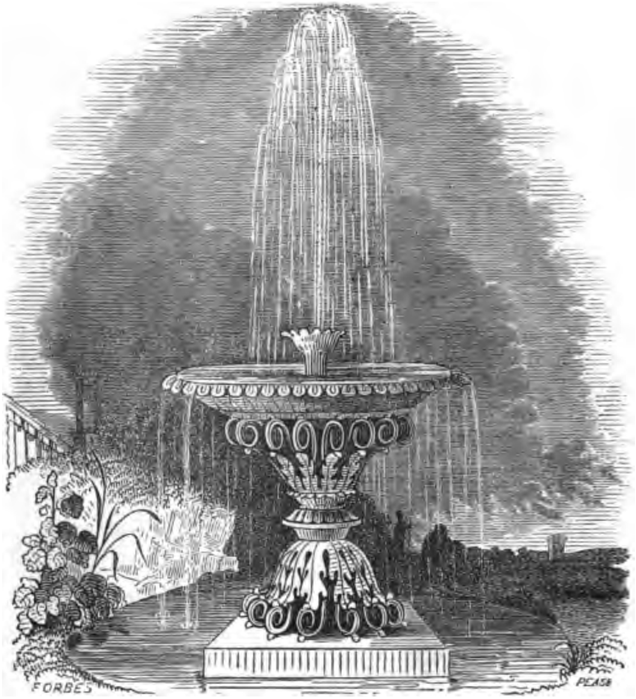
No. 8, $65.

No. 8.—A square base, eight leaves, supporting a basin same as No. 6. On the edge of the basin are six swans; in the centre is a a figure of Hebe. The jets, as represented, come only from the swans; but there is a jet from the head of the figure, (same as No. 4,) and the two points for the streams to play from can be so arranged that either one or the other may be used separately, or both combined.



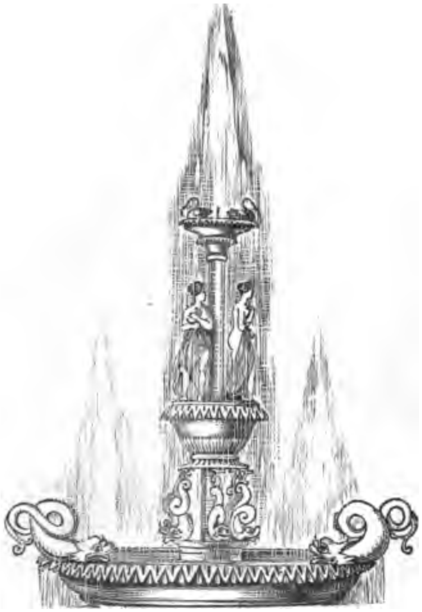
No. 9, $85.

No. 9 represents a scroll base, five feet diameter supporting a basin four and a half feet diameter. In the centre of the basin is a circle of leaves, rising inclined inward, and supporting an urn, on which, surrounding a column, are the three figures of Venus leaving the bath. The column above is ornamented, and between the leaves, immediately above the pan, are six small swans, each playing a stream of water into the basin below. These, with the centre stream, form the full display of water. I put up one of this kind in the American Museum, in this city, and it was universally admired; and in August, 1848, P. T. Barnum, Esquire, had it removed and placed at his residence in Bridgeport, Connecticut. Height, six feet



No. 10, $85.

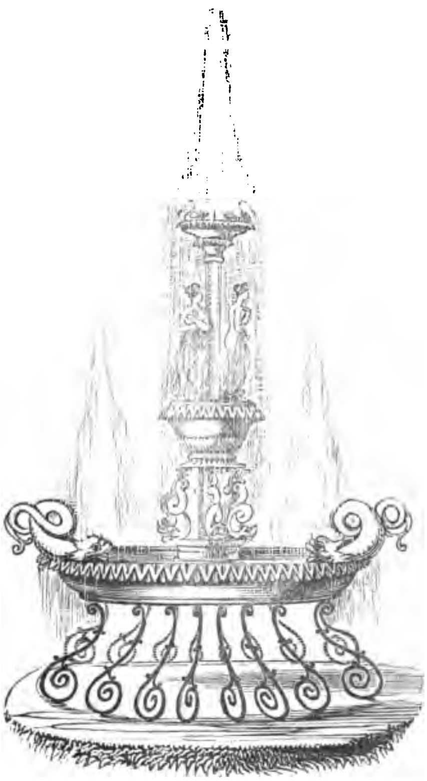
No. 10.—Diameter of the base two feet three inches; height to the top of the pan about four feet; whole height, five and a half feet. The cut gives a good representation of the general effect of the fountain. It makes a very handsome appearance when put up, and with two good coats of paint a year, its pleasing effect will remain undiminished.



No. 11, $90.

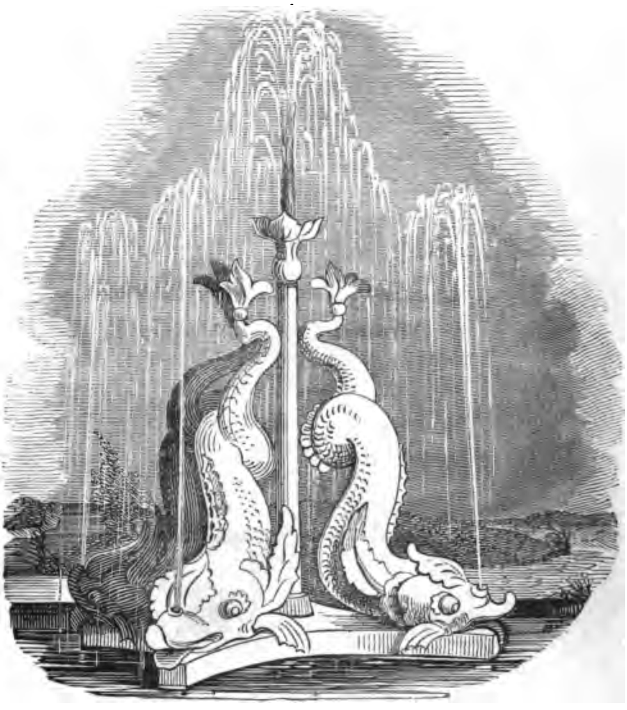
No. 11.—This cut is deficient in not representing the panel base, which may be seen in cut No. 14 under the basin. It is also deficient between the urn and figures, and above the figures some ornaments are not represented.

The basin and dolphins are about five and a half feet diameter, and the whole is six feet high. A great number of this pattern have been furnished for various situations, and they have been generally admired.



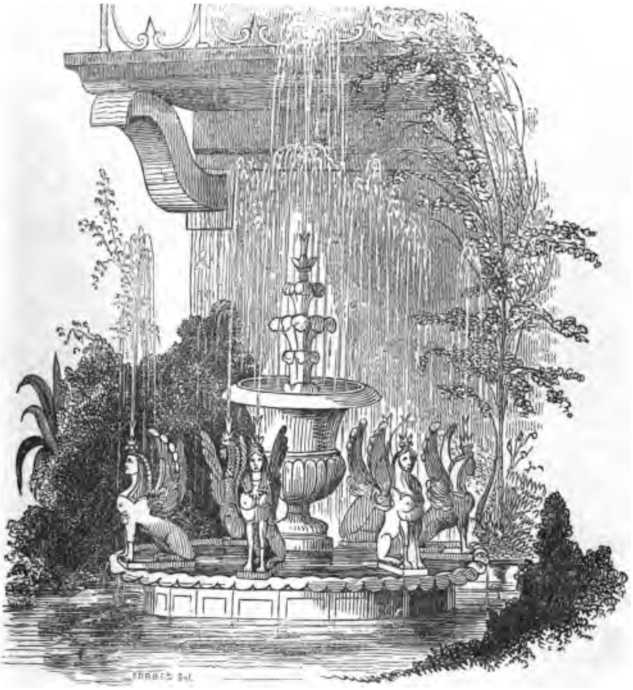
No. 12, $100.

No. 12 is similar to No. 11, but the addition of a scroll base instead of the panel base, raises it up about 12 inches higher than No. 11; and there are some few additional ornaments. The streams are from the four Tritons on the edge of the pan, and from the lily on the top of the column. This fountain ought to be set in a basin eight or ten feet diameter. The height is about seven feet.



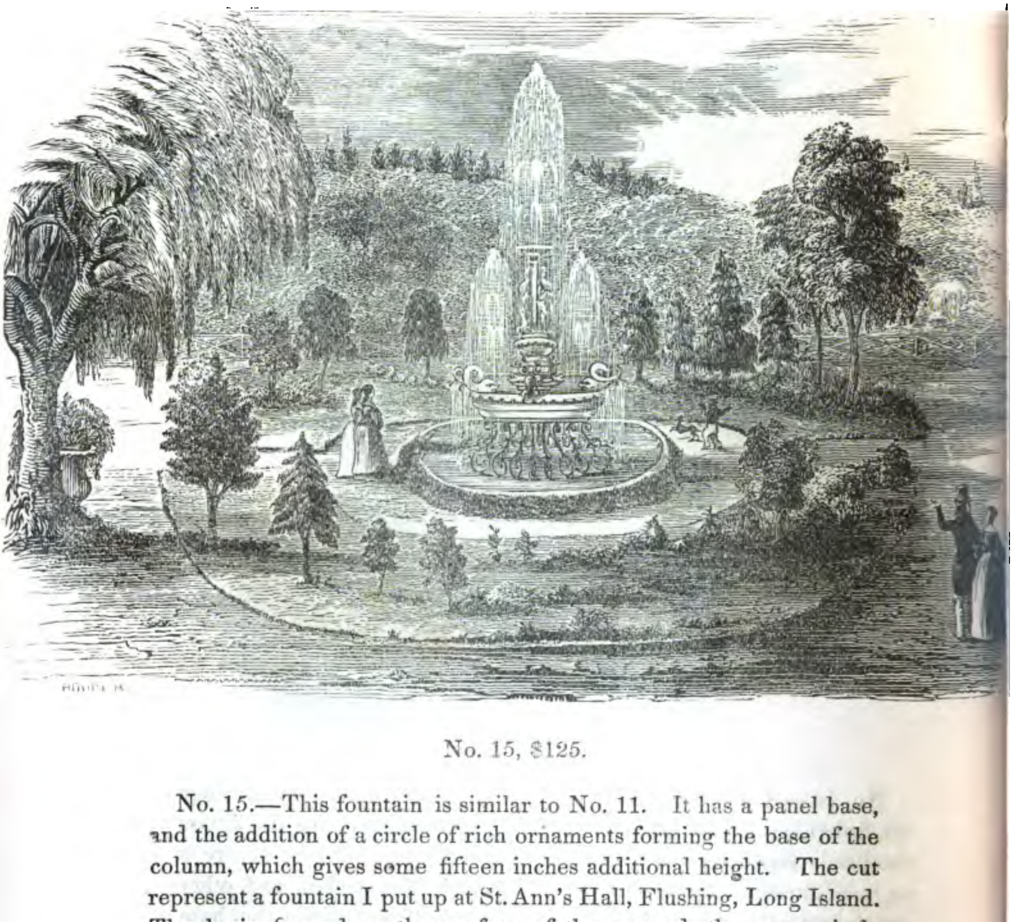
No. 13, $100.

No. 13.—The whole height of this fountain is five and a half feet; diameter, five feet. Its features are bold, not unpleasant, and present appropriate emblems for a display of jets of water. The dolphin is a classical representation of one of the most beautiful inhabitants of the ocean, and is the most common figure in all ancient fountains. None, perhaps, is better calculated for a point from which to start a jet. This fountain is best calculated for irregular scenery where the immediate landscape is broken, as it presents nothing of the soft and fascinating.



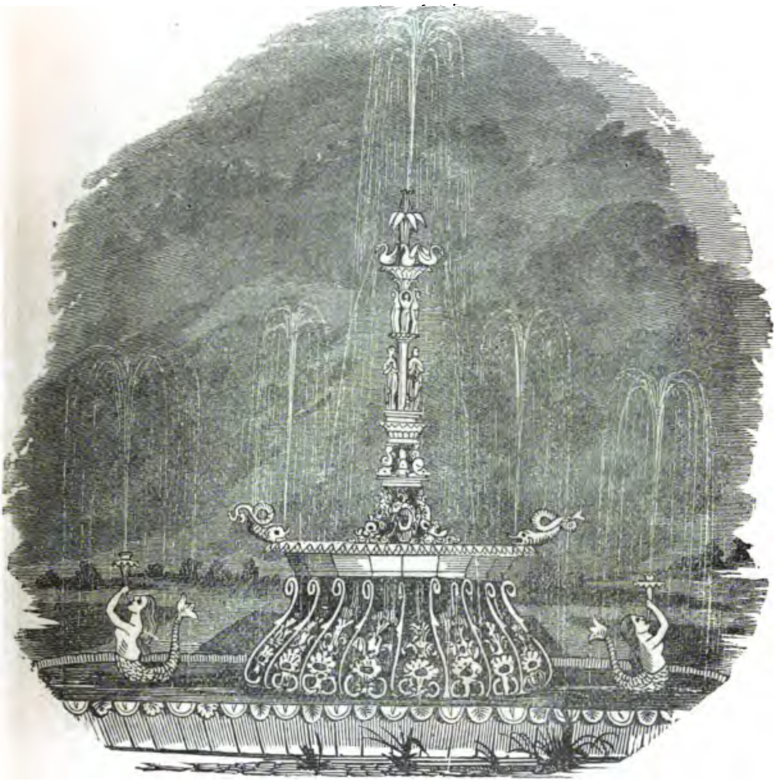
No. 14, $115.

No. 14.—A panel base, with pan or basin, supporting on its edge six Sphynxes. These figures are of Egyptian origin, and the lily on the heads form very pretty starting points for jets. In the centre is an urn like that represented in No. 5, and lilies, leaves, and other ornaments—the whole being five and a half feet high; the base divided into 16 panels, and is three and a half feet diameter. The jets from the centre with those from the Sphynxes form a handsome display of water. This fountain has been very much admired.



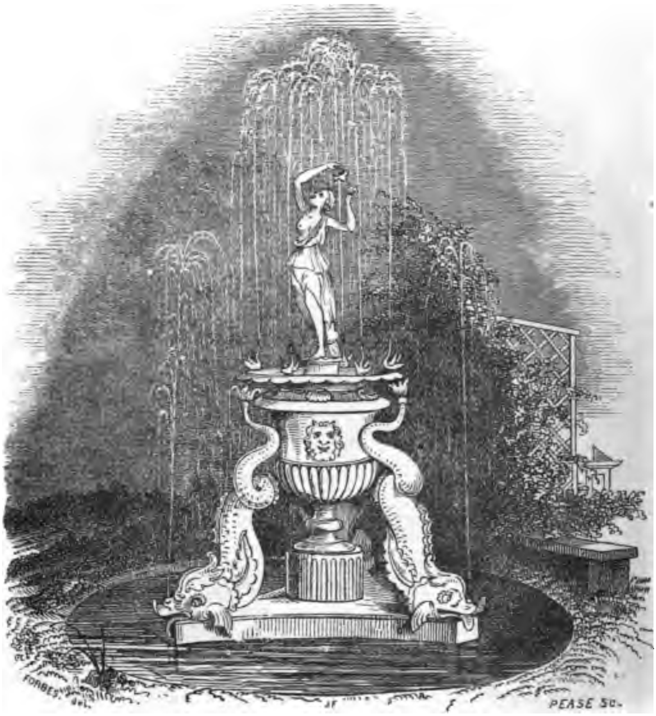
No. 15, $125.

No. 15.—This fountain is similar to No. 11. It has a panel base, and the addition of a circle of rich ornaments forming the base of the column, which gives some fifteen inches additional height. The cut represent a fountain I put up at St. Ann's Hall, Flushing, Long Island. The basin formed on the surface of the ground, the outer circle raised about 15 inches, and the bottom about nine inches; the inner surface coated with hydraulic cement, and paved with small pebbles; the outside covered with turf. The whole finished, and the fountain put in operation, in one day.



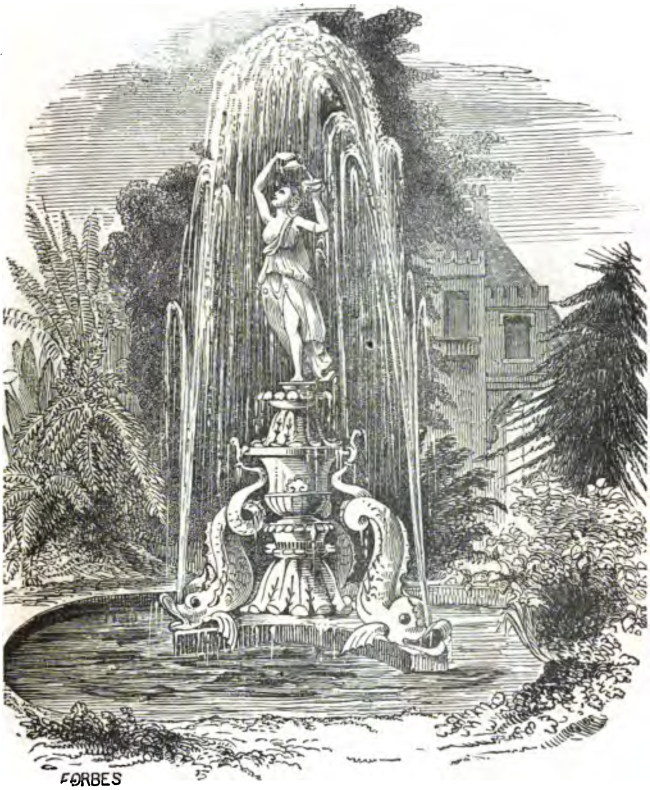
No. 16, $150.

No. 16.—The price named above is for the fountain exclusive of the large basin and side figures. It stands about eight feet high, and has 21 figures, viz.: 10 Dolphins, three figures of Venus, four Graces, and four Swans. I have built as many of this style, perhaps, as any other pattern, and they have been generally admired.


FORBES del.
PEASE Sc.

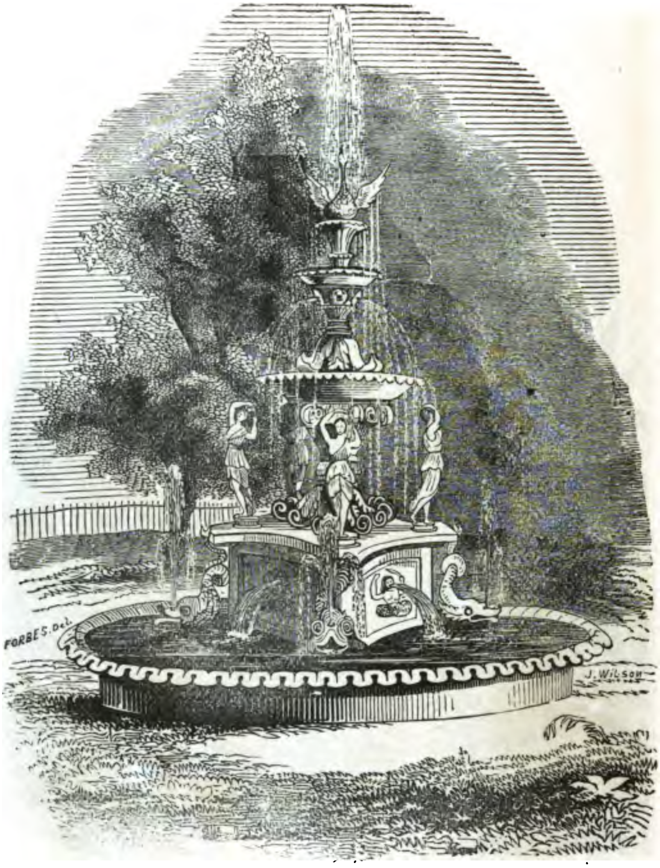
No. 17, $175

No. 17.—This fountain is seven feet high, and about six feet diameter at the base. The cut is a tolerably fair representation. The dolphins are three and a half feet high; above the urn is a basin supported by six shells; on the edge are six swans, each playing a stream of water over the figure of Hebe, which, with those from the dolphins, and streams from the three masks on the urn, and from the head of the figure, give quite a varied display of water. The diameter of the basin for a fountain of this size should not be less than 12 feet to produce the full effect.



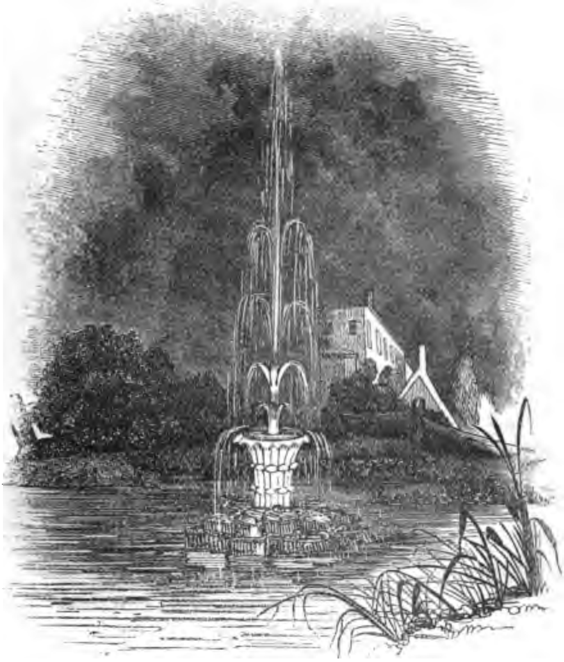
No 18, $200.

No. 18.—This fountain has a very rich and classic appearance, and cannot fail to strike the attention of observers as combining beautiful proportions and elegance of detail, with sufficient variety to render it pleasing, viewed from different positions, or at different times. It is sufficiently large for any private grounds, the height being eight feet, and diameter at the base six feet. The figures on the urn can be masks, in the Egyptian style, or shells.



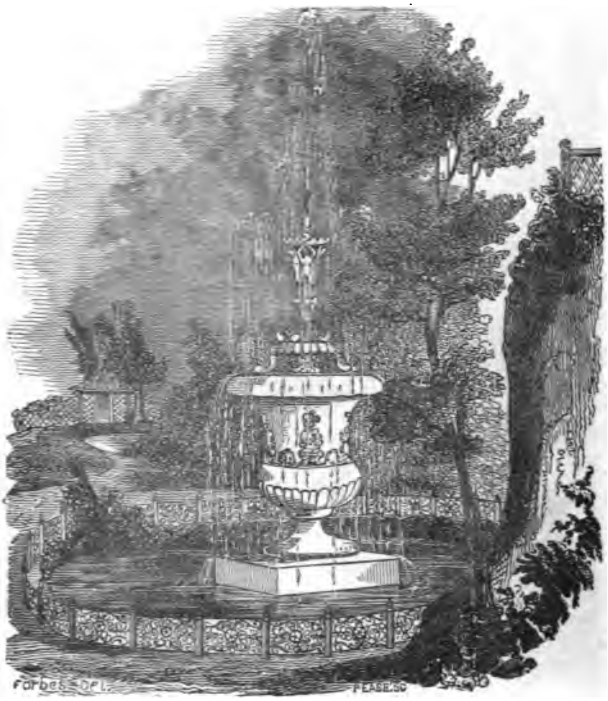
No. 19, $1500.

No. 19 represents a large fountain for public grounds—height 13 feet, and the diameter of basin 15 feet. When the basin is not wanted, the fountain can be furnished for $1000. The diameter without the basin is 10 feet. The engraving does not do the fountain justice, and to those wanting a larger representation I can furnish drawings. This represents the largest I have manufactured; but when desired, I can furnish them of any size. I have drawings and plans for them 30 feet high and 25 feet diameter at the base, with figures for side streams that will form a diameter of 45 feet.



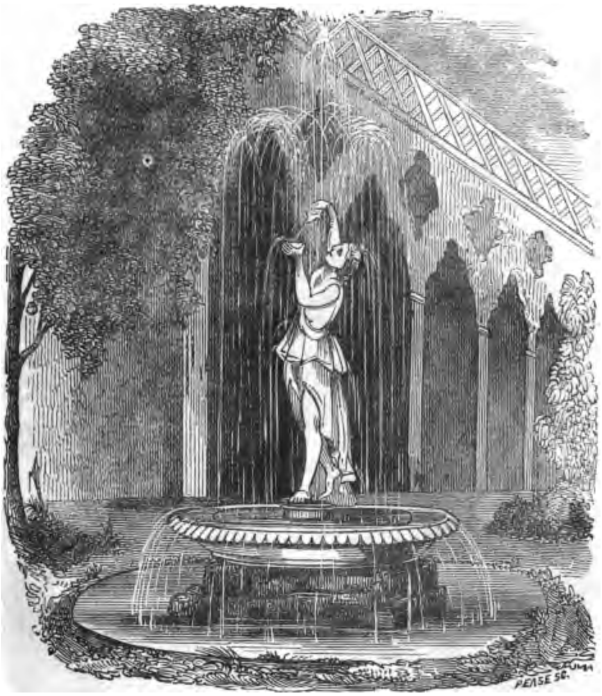
No. 20, $15.

No. 20.—The lower part of this fountain is the same as that described as No. 1. It has the addition of a basin on the top, a post and ornaments, which increase its height and improve its appearance. Height, two feet six inches.



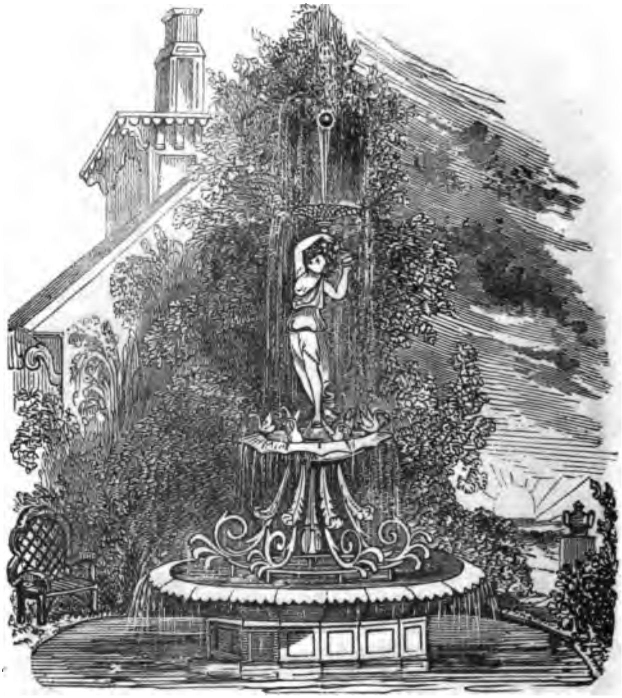
No. 21, $35.

No. 21 represents the urn, (see cut No. 2,) with an addition of the ornaments, as shown on the cut, and a column passing up from the centre, ornamented with leaves, figures, and a lily at the top. At the base of the column are three small swans sitting upon a pan and resting upon the edge of the urn by means of six shells. Height, about five and a half feet. It is a very neat and chaste fountain.



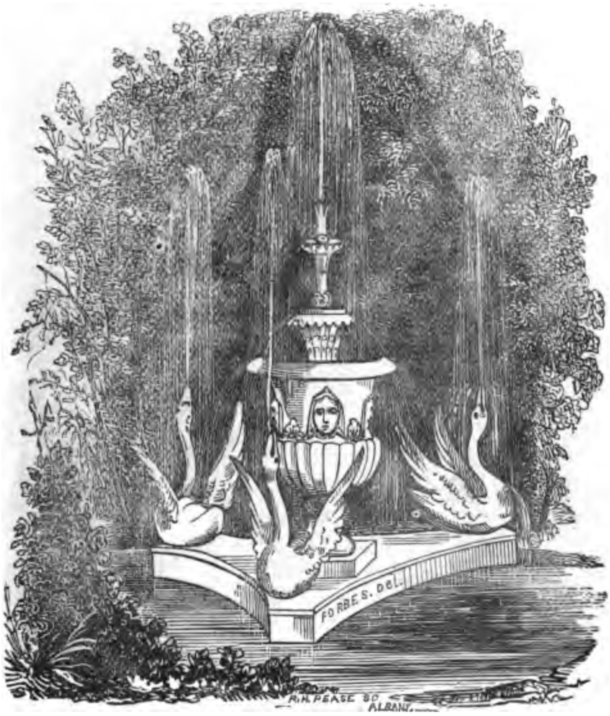
No. 22, $50.

No. 22.—This represents a pan four feet four inches diameter, with a figure of Hebe in the centre three feet two inches high. Around the base of the figure is a ring of pipe, even with the surface of the water, forming a circle of three feet diameter. The upper part of this pipe has openings, from which a circle of jets rise over the figure, presenting a pretty effect, and a jet from the head of the figure not shown.



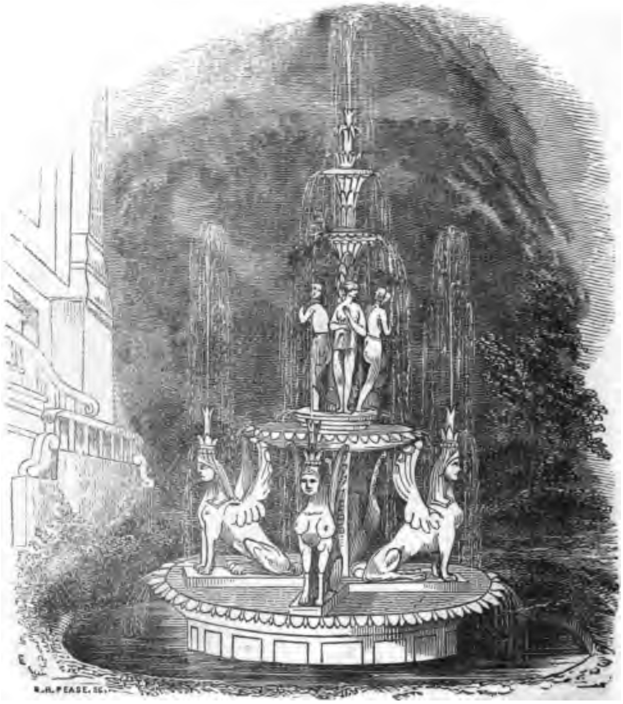
No. 23, $85.

No. 23.—This fountain consists of a panel base, basin four and a half feet diamoter, scrolls, pan, six swans, and figure five and a half feet high. The water plays from the swans, and from the centre above the figure. A basket and ball is represented which does not belong to the fountain, unless so ordered, at an additional price of three dollars and fifty cents.



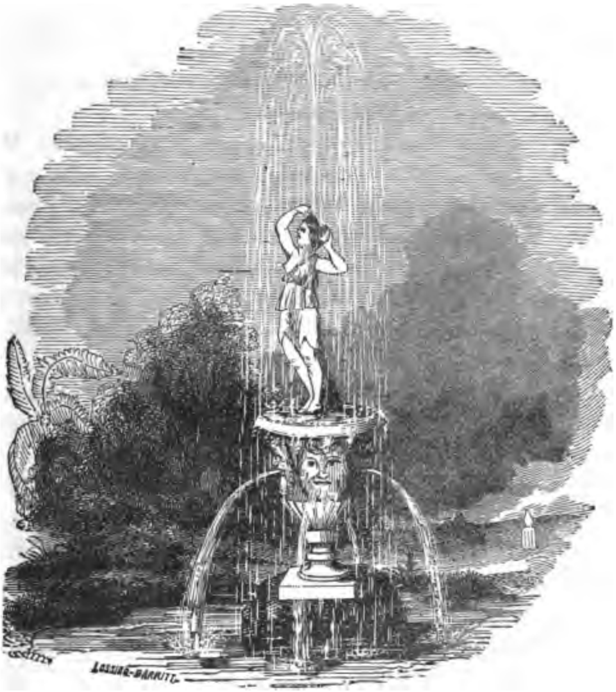
No. 24, $85.

No. 24.—The urn and work above it are nearly the same as No. 6, to which are added the triangular base and three swans. The end of each pipe is furnished with a screw, that the jets may be changed to suit the fancy. Having a great variety, such as single stream, rose, cross streams, umbrella, etc., changes may be made to suit the most fastidious.



No. 25, $100.

No. 25.—This fountain is well represented. The base, pan, and Sphynxes are like No. 14, except there being four instead of six figures. The column, pan, figures of Venus, and ornaments above are well defined in the cut, and need no further explanation. The height is six feet four inches.



No. 26, $40.

The above cut consists of an urn, as represented in plate No. 2—plain urn, 30 inches high, 25 inches across the top—and having four full-size faces of satire around it, so arranged that the water flows from their mouths, as represented. Just even with the top of the vase stands the figure Hebe, three feet higher, making the entire height five feet six inches.

The jet of water comes from the crown of her head, giving the entire fountain a chaste and neat appearance.

REMARKS ON CAST IRON FOUNTAINS.

The foregoing cuts of Fountains, form but a part of the variety I have manufactured, perhaps combine as much beauty as others that I have no engravings to represent. Fountains of iron only require to be properly painted twice or three times a year to keep them looking as well as when first put up. When they are *entirely* covered, so as to close the pores, wherever the iron rust may escape, then painting them spring and fall is sufficient.

Iron has a decided advantage over marble for fountains. When water runs on marble for a time it becomes covered with a green vegetable matter, that penetrates the stone, which when once discolored cannot readily be restored; and in northern climates marble is affected by frost, so as to scale and injure its beauty. These objections do not exist against iron, while it can be formed into the most beautiful figures or designs at less than half the cost of marble, and boxed and transported at a fraction of the expense. In all cases they require to be placed in an artificial basin from five feet diameter to any size or shape the taste and situation may dictate. The depth from eighteen inches to five feet, made of brick, and cemented. The sides, instead of being perpendicular, ought to be sloping inwards from the outer edge to the centre, upon a circle. The basin can be raised above the water in the form of a mound, or just even with it. Fountains will be boxed carefully, and forwarded to any part of the world, with all the directions for putting them up.

All the pipes, couplings, stop-cocks, and a *complete assortment of jets*, are included with each.

Having embarked extensively in the business, I intend to bring it to as great a perfection as possible, and shall be able to suit the taste of any person desiring Fountains, etc. or jets, either single streams, rose, umbrella, revolving, and cluster jets, and made for any size pipe or opening that may be required.

ROTARY PUMPS.

Pumps of this kind have been used in different parts of the country for many years; and some persons, having them in use under favorable circumstances, are satisfied of their operation, while others condemn them. For any moderate height, with water perfectly free from grit of any kind, they may work well for a length of time. When water is to be raised any considerable height, they require a great increase of power beyond that of cylindrical pumps to produce an equal effect. Mr. Ewbank, in his valuable work on Hydraulic Machines, thus speaks of rotary pumps :

"These machines have been variously modified as pumps, but generally speaking they are more complex, and of course more liable to derangement than others. We have known two of them, 15 inches diameter, and apparently well made, (at a cost of $150,) which a friend used to force water to an elevation of 20 feet, become deranged and thrown aside as useless in the course of three or four weeks.

"Rotary pumps have never retained a permanent place among machines for raising water: they are as yet too complex and easily deranged to be adopted for common use. Theoretically considered, they are perfect machines; but the practical difficulties attending their construction have hitherto rendered them, like rotary steam engines, inferior to others. To make them efficient, their working parts require to be adjusted to each other with unusual accuracy and care; and even when this is accomplished, the efficiency is, by the unavoidable wear of those parts, speedily diminished or destroyed.

"Their first cost is greater than the common pumps, and the expense of keeping them in repair exceeds that of others. They cannot, moreover, be repaired by ordinary workmen, since peculiar tools are required for the purpose. A farmer might as well undertake to repair a watch as one of these machines. Hitherto a rotary pump has been like the Psalmist's emblem of human life—'its days are as grass: as a flower of the field it flourisheth; the wind (of experience) passeth over it, and it is gone.'

"Were we inclined to prophecy, we should predict that in the next century, as in the present one, the cylindrical pump will retain its pre-eminence over all others, and that makers of them will then, as now, defy all attempts to supersede the object of their manufacture."

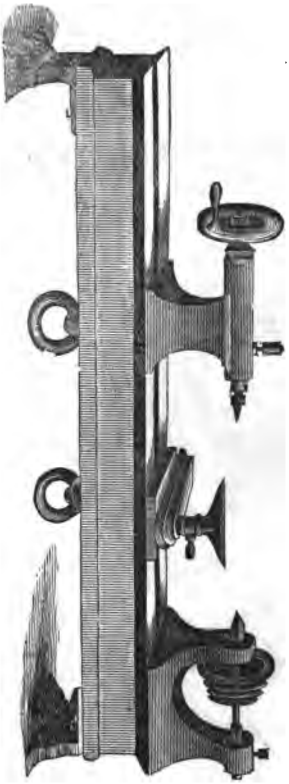
COPPER WORK FOR PLUMBERS, &c.

The advantages of having work of the above description performed by a faithful and experienced workman, will be apparent to all, as much of the value of all kinds of labor in this department depends upon the faithfulness of those to whom it is entrusted. Among others in this city, Mr. Wm. H. Graves, 276 Water-street, stands pre-eminent. He manufactures, in the best manner, and at the shortest notice, all kinds of Copper Work for Plumbers, etc., such as Croton Boilers; Open Boilers; Sinks or Basins, round, oval, or square; Copper Bathing Tubs; Shower Baths; Floats; Pump Chambers, etc., etc.; Hatters,' Dyers' and Brewers' Kettles; Tallow and Oil Kettles; Gum Kettles, for varnish-makers; Stills and Worms; Soda Fountains; Self-Generators, for bottling; Confectionery Pans; Tanners' Heaters; Oil Coolers; Steam and Water Boilers, of all kinds and sizes; Copper Pipes, of all sizes; Ley and Brewers' Pumps; Cask and Liquor Pumps; Hollow Ware Patterns—together with all other articles in this line.

MACHINISTS' TOOLS, GEARING, PRESSES, &c.

Having been frequently consulted in regard to many articles of this description, and also having orders for the same, I have made arrangements with one of the best establishments in this country for supplying, at the shortest notice, everything that may be desired in the above department. Messrs. Oliver, Snow & Co., Union Works, Meriden, Conn., are the enterprising proprietors; and in addition to the several articles which are presented in the following catalogue, they also manufacture all kinds of Mill Gearing, Shafting, Hand Lathes, Turning Engines, with or without screw gear, Planing Machines, for iron, Slide Rests, Chucks and Screws, Tool Stamps, Dies for Tinners, Screw Lever and Power Presses, Trip Hammers, Railroad Car Wheels and Axles, Horse Powers, Iron Water Wheels, etc., Brass and Iron Castings, from one ounce to five tons.

HAND LATHE.

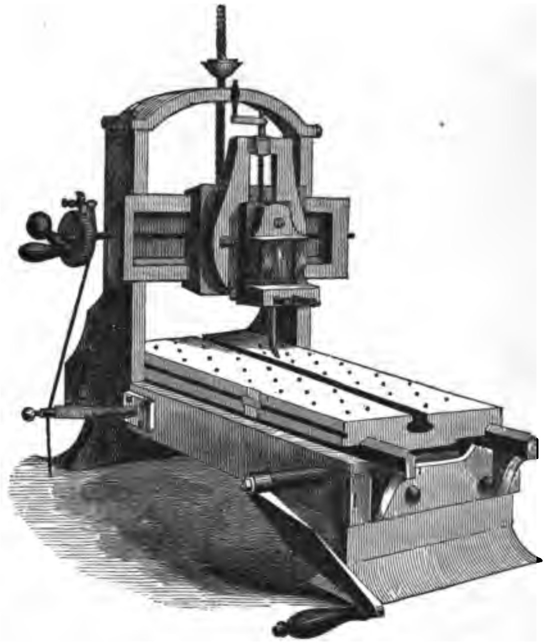


The above cut represents a small hand-lathe, (without face plate,) designed for the use of silversmiths, jewelers, dentists, brass-turners, etc. They can be arranged to go by foot or other power. Slide rests, back gear and chucks added, when required. Sizes as follows :

No. 1,	length of ways,	20in.	Height of centres,	3in.	Price,	$12
" 2,	"	26in.	"	3¾in.	"	16
" 3,	"	36in.	"	4½in.	"	24
" 4,	"	48in.	"	5in.	"	36
" 5,	"	60in.	"	6in.	"	50

The prices are reasonable, and depend upon the finish, etc.

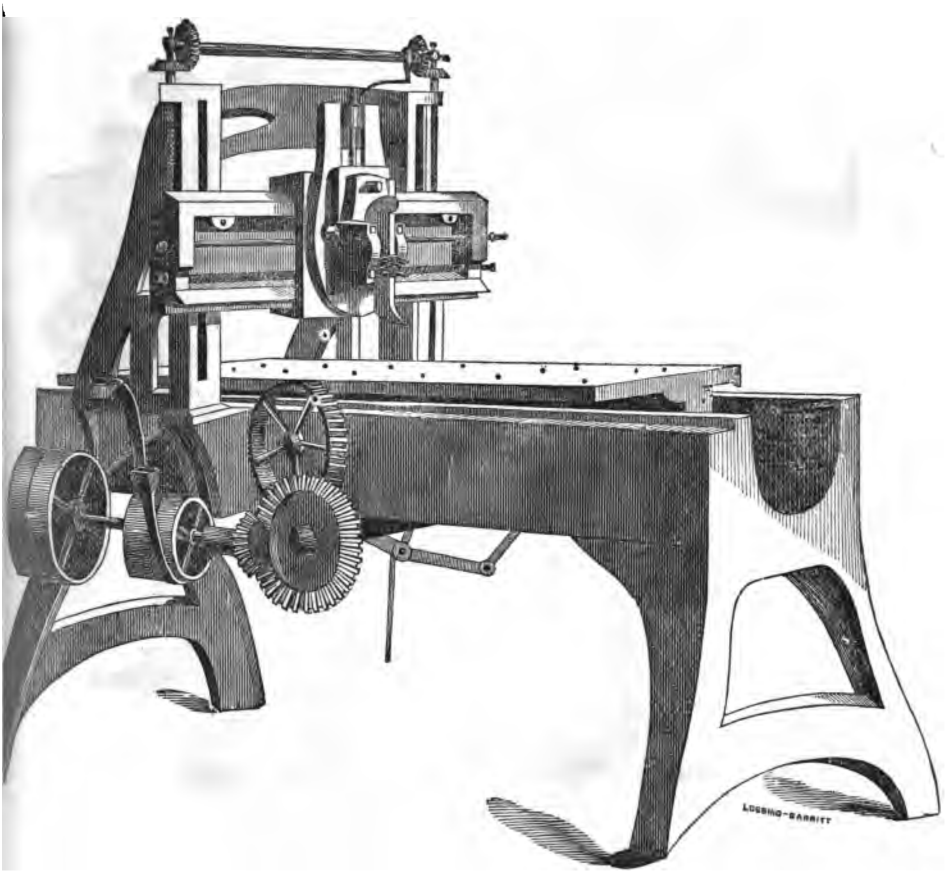
HAND-PLANER, FOR IRON.



The above cut represents a hand-planer, with self-acting feed. It is a valuable machine for small machine shops, die-makers, and manufacturers. We have three sizes of this style of machine, viz.:

No. 1,	Length of ways,	28in.—	Mill Plain,	22in. long,	10in. wide.—	Price,	$ 90
" 2,	"	40in.	"	32in. "	12in. "	"	120
" 3,	"	52in.	"	42in. "	16 &20 "	"	175

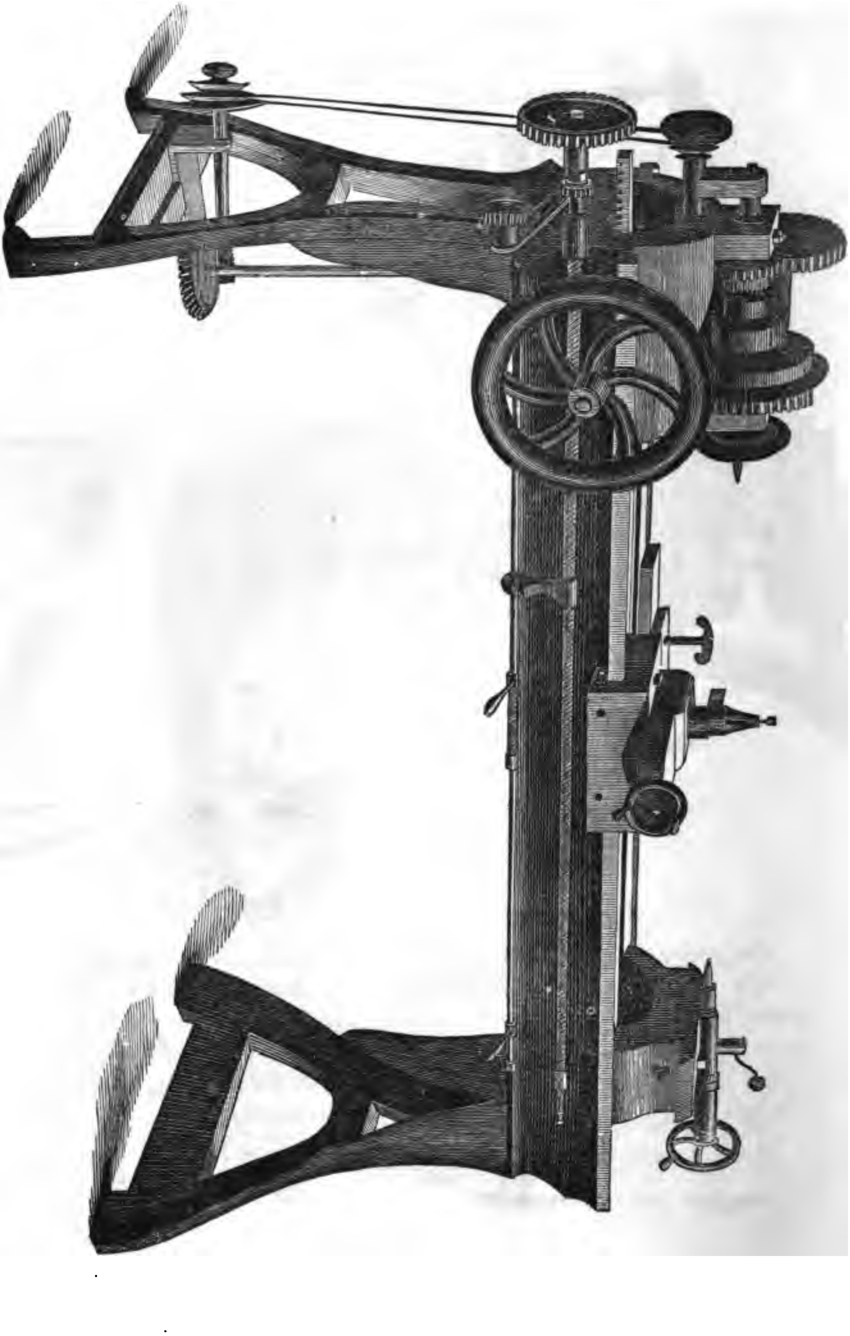
POWER PLANER.

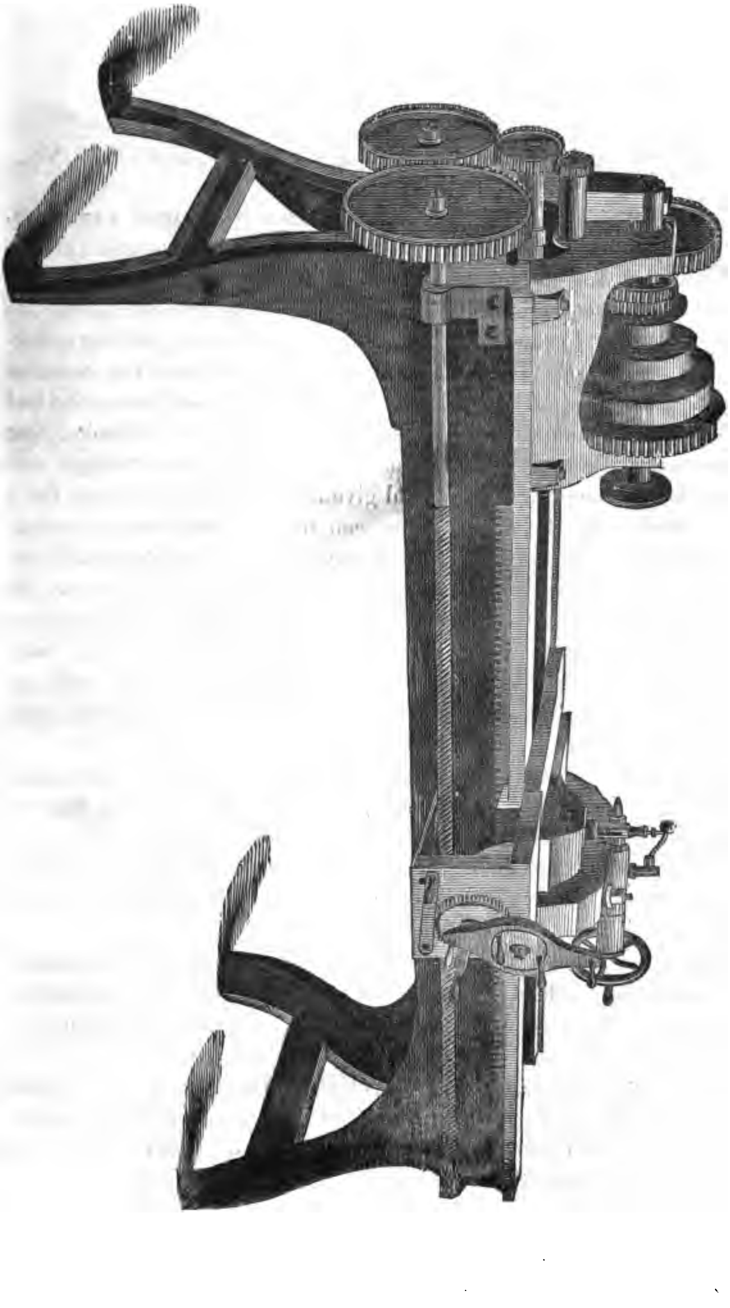


The above cut represents a Power Planer, with compound feed, —rack movement, etc. Length of ways, 6 feet 4 inches — mill plane, 5 feet long and 25 inches wide. This is a very strong and substantial machine, weighing about 3500 pounds, and has given universal satisfaction. We make them to order, of the following sizes :

Length of ways,	5 feet.	Width,	20in.	Weight,	2000 lbs.	Price,	$275
" "	6ft. 4in.	"	25in.	"	3500 "	"	500
" "	10 feet.	"	26in.	"	4500 "	"	650
" "	12 feet.	"	35in.	"	8000 "	"	850

Compound feed from $50 to $75 extra.





LATHES, FOR TURNING AND SCREW-CUTTING.

The cut on page 104 represents a perspective view of a small engine lathe, for turning and screw-cutting. (The screw-cutting gear is thrown out, and left for the purpose of turning.) It will be seen, by the cut, that no weight is required to hold down the rest carriage, as it is held firmly in its place by jibs attached to the same, sliding underneath the ways. The advantages of a jib lathe over the common weighted rest is very great, in regard to strength—allowing the bed to be cast in such a form, and is so connected by cross-braces, that the same weight of iron gives more than double the strength that the same amount of metal would give in a common lathe bed, for a weighted rest. It will also be seen that the slide rest is so constructed that the point of the tool may be raised or depressed, by means of a thumb-screw, which is a great improvement on any jib rest we have before seen, especially for a small lathe. This lathe is six feet long, and swings fourteen inches, with screw gear, complete, finished in the best manner—price $200. Same, without screw gear, $158. For common slide turning, without back or screw gear, $125.

The cut on page 105 is a perspective view of our eight-feet engine lathe, for turning and screw-cutting. The bed is of similar form to the smaller size, which gives it great strength. The feed gear is attached to, and underneath the rest carriage, the motion of which is derived from a worm wheel, which revolves with the screw in plain turning.

In screw-cutting, the movement of the rest carriage is derived by means of the leading screw-box, which is thrown into connection at pleasure, by means of a lever and handle in front. Consequently, there is no wear on the screw, except when cutting screws. This lathe is eight feet long, and swings sixteen inches, and weighs 2000 pounds. At the Fair of the American Institute, held in the city of New-York, in 1849, the Committee awarded us a silver medal on this lathe, as being the *best* medium-size lathe exhibited.

The sizes and dimensions are as follows :—

Length of bed,		8ft.	Swings	16 to 20 in's.		Weight,	2000 lbs.		Price,	$225
"	"	12ft.	"	16 " 20 "		"	2700 "		"	275
"	"	12ft.	"	26 inches.		"	5000 "		"	550
"	"	12ft.	"	32 "		"	5500 "		"	650
"	"	24ft.	"	32 "		"	8500 "		"	800

Geared for cutting screws, with counter shaft, hangers, and double clutch, from $75 to $150 extra, according to the size of lathe. Common counter shafts, with pulleys and hangers, complete, from $12 to $20, according to the size of lathe.

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Description of Farnam's patent hydr
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